Ph.D. Dissertation of Economics

The Effect of Rural Development Policy on Farmland Conservation and Community Capacity

농촌개발정책의 농지 보존 및 지역사회 역량에 미치는 영향

February 2020

Graduate School of Agricultural Economics and Rural Development
Seoul National University
Regional Information Major

Mika Wakamatsu Shin

Abstract

There is a vicious circle characterizing the economic situation in many rural regions. Farmland abandonment is one of the complex circles and causes economic stagnation, environmental and social problems such as depopulation, row productivities, migration and dropping food supply self-sufficiency and some of the interlinked factors among them. As consequences of these situations, it has been observed that this makes the vicious circle that farmland abandonment is increasing even more and problems of these are getting more serious. Therefore, it is essential to understand value of farmland and its multi-functions and to restrain farmland abandonment along with fostering community capacity in rural area. Moreover, in the theory of neo-endogenous rural development, the importance of local resources such as farmland and community capacity is mentioned as key factors for sustainable rural development.

Considering the importance of multi-function of farmland and community capacity, it is necessary for many rural regions to take measurements with multi-dimensional perspective to contribute to maintain the farmland and foster community capacity.

However, there is very few researches on discussion of sustainable

rural development focusing on farmland and community capacity with empirical studies. Since sustainable rural development has broad contents, there is very few studies focusing on the relationship between multi-function of farmland and sustainable development based on empirical study. Therefore, in this dissertation, it is trying to clarify the effect of direct payment for hilly mountainous area of Japan and community capacity on farmland conservation in order to organize concept of sustainability through role of farmland. It also tries to find out how it links to sustainable rural development. The results and discussion from this dissertation would bring better understanding on the importance of multi-function of farmland as community's asset and territorial integration policy. Furthermore, it would clarify challenges of case of Japan and make them into policy implication for future policy or other countries.

Especially, the effective governmental intervention and diversity of stakeholders are key factors for sustainable rural development as mentioned in the theory. This research can indicate specific implication for sustainable rural development by focusing on multi-function of farmland and conservation activities. It would bring academic contribution to the theory development and also the

academic field of sustainable rural development policy. In order to maintain farmland, it is well known that community capacity is playing the key role. Even so, the discussion on the relationship between sustainability and role of community capacity are very few with empirical studies. In this point, this dissertation can clarify the importance of community capacity through farmland conservation activities and give implication on community capacity building.

First essay is verifying the effect of direct payment for hilly mountainous area and community capacity on restraining farmland abandonment. In this essay, we use panel data and Difference in Differences (DID) estimator to estimate the effect of the policy by comparing treated group with controlled group. At the same time, if the policy brings the effect on reducing rate of farmland abandonment, it is trying to clarify what community's features influence into the effect. As a result, the area of target of the policy has more effect of reducing farmland abandonment compared to non-target area. Moreover, the more share of 65 years old farmers, the more abandonment was restrained. This could be explained that long term accumulation of capacity for collective activities is the key factor to achieve governmental new program with incentives. We conclude that it is necessary to encourage stakeholders by the

policy to lead community capacity building for farmland conservation.

The second essay is investigating the efficiency of the direct payment for hilly mountainous area since it is one of payment for ecosystem services (PES) and recent discussion is spread in questioning efficiency of the PES. It is generally difficult to measure efficiency of Japanese type of direct payment because it does not aim at specific goals such as kinds of biodiversity or soil condition improvement. Therefore, we utilize flooding damage mitigation effect as standard of efficient use of the direct payment. We assume that if the farmland avoiding abandonment by direct payment can mitigate flooding in some level, it is assumed that the payment on the farmland was executed efficiently. In addition, in the age of climate change, we suppose that flooding damage might increase in the near future. So, we utilize RCP8.5 scenario and calculate damage cost based on the scenario with precipitation. We use panel data and Tobit model to estimate correlation between damage cost and direct payment effect. At the same time, we estimate if community collective activities have influences into disaster mitigation. As a result, the disaster mitigation was observed in both where they are the target area of the direct payment and

where they have community's collective farmland conservation activities compared to non-target non-activities area. From this result, it is possible to say that efficient use of direct payment needs community's collective conservation activities. Prediction of damage cost under RCP8.5 scenario shows increasing in almost all the area of the study area. We conclude that it is necessary to confirm importance of multi-function of farmland and conservation activities by the community for maintaining farmland in the age of climate change.

These two essays lead conclusions as below. Firstly, it is significant to understand value of multi-function of farmland and restrain farmland abandonment for sustainable rural development because this mentioned multi-function of farmland brings not only production but also disaster mitigation, rural economy opportunities and cultural value on the residents. Secondly, fostering community capacity is key for maintaining farmland with encouraging by governmental intervention. Lastly, the community collective activities bring efficient implementation of governmental intervention. Therefore, in terms of farmland conservation activities with the direct payment, it has to implement with incentive for stakeholders. Japan is one of countries where they face decrease of

farmers and new entities. It is necessary to give incentives to new entities not only for individual farmers or large scale of full-time farmers but also private company or part-time farmers and new type of farmers to secure stakeholders. Farmland use should be considered depending on the regional characteristics. In this decade, it is not easy to manage farmland only by large scale farmers or full-time farmers since the number of farmers are decreasing year by year. It is the time to include part-time or small-scale farmers and new type of entities for community farmland maintenance with incentives by the governmental intervention with balanced community self-sustain so that the local resources and higher community capacity make it possible to pursue sustainable rural development.

Keyword: Farmland abandonment, Multi-function of farmland, Community capacity, direct payment, Sustainable rural development
Student Number : 2014-31491

Table of Contents

List of Tables

List of Figures

.

Chapter 1. Introduction

1-1. Study Background

In rural area, there is a vicious circle characterizing the economic situation in many rural regions. “The New Rural Paradigm” (OECD 2006). Low population density causes lack of services and infrastructure in rural area. As the result, they face lower rates of business creation and fewer businesses result in fewer jobs. It induces out-migration and ageing as obvious in Japan. It comes back to again leading to low population with stagnation of rural socio-economy.

In the “New Rural Paradigm”, it says that traditional agricultural sector policies should be replaced by territorially-oriented rural policies and integrated rural development is needed. Recent governmental intervention on rural development policies are remarkably showing us the shift from top-down with infrastructure to balanced bottom-up and top-down policy focusing more on human resource development policy. In agricultural sector, territorially-oriented rural policies and integrated rural development are recently major issues. It is focused on the importance of multi-function of farmland along with community collective activities for

maintaining farmland. It pursues not only improving agricultural production but also sustainable rural development through maintaining farmland.

When we consider sustainability in rural area, it can be contradicted between two aspects: local resource conservation and economic existence. Both aspects are linked with sustainability since ecological conservation is realized by natural resource conservation which can be the farmland conservation issue in the rural area. On the other hand, the economic existence is the motivation of people for their better livelihood. When people pursue economic development, they scarify natural resources in general. However, it would be possible to achieve both sustainability on local resource conservation and socio–economic development all at one time (Van Lier and Planning 1998).

This is an important argument to create a sustainable rural system. It is necessary to develop sustainable rural agriculture and related activities with conservation of local resources. To do so, it is necessary to have intervention of government to give incentives to people who are engaged in the agriculture and related activities if they realize environmental conservation activities. This is because even though farmland is owned by individuals, the function of the

farmland contains characteristics of public goods. In addition, conservation of the farmland is not only matter of the residence but also whole community because it has role of production basement, disaster prevention, and community history and habitant preservation. Thus, government has the important role to conserve such function for community. Under this concept, government of Japan has been implementing the direct payment for hilly mountainous area, for farmland and water conservation and so on. These direct payment schemes prioritize promotion of community's collective activities through management activities by the intervention. To restrain farmland abandonment is an urgent issue because farmland has a role of public goods in terms of environmental conservation and so on. Also, the policy has to consider community capacity fostering because people who are engaged in such conservation activities play important role.

For sustainable rural development, it is important to understand the value of the multi-function of farmland. In the age of climate change, the regions where the vulnerability toward disasters contain problem of degradation of farmland and lacking of stakeholders. Japan is not the only country who faces the rural vulnerability. Other countries or regions would have similar situation in these

decades. Especially, farmland abandonment is seen in many regions. Farmland abandonment leads more rural vulnerability regarding of disaster prevention function as negative consequences of abandonment.

The history of the direct payment is seen in the transition of rural development policy of EU countries such as the payment for less-favored area (LFA) and agricultural policy of decoupling and recoupling. It was one of the pillars of Common Agricultural Policy (CAP) in European countries as beginning of income compensation for farmers who LFA. The United Kingdom (UK) was the first country to adopt direct payment to promote agricultural activity in mountainous areas where it is difficult for the farmers to efficiently produce their crops. The direct payment became popular and gradually added expected achievements for rural areas where they are facing depopulation. Therefore, EU countries established CAP for the fundamental reform process and designed their policy shifting from supporting agricultural price to supporting direct income gap between farmers in LFA and other normal conditions as policy of rural development. It promotes not only securing productivities but also environmental benefits, better rural landscapes, and sustained the competitiveness of rural areas. OECD

defines that the direct payment is one of the agricultural protection policies and its purpose is to support income of farmers and to adjust market failure by externality (FAO 2005). The concept of the direct payment has been discussed among OECD countries, but after discussion of decoupling of direct payment around 1990-2003, it shifted focusing more on the activities of farmers. After 2000, the discussion came to consider more with promotion of the environmental conservation activities.

Japanese government also shifted drastically the agricultural policy from price support to the direct payment LFA as income compensation since 2000. This dramatical shift had occurred because of failure of price support policy which induced degradation of agriculture in Japan and also increased farmland abandonment due to economically rational behaviors of farmers during alternation of generation (it will be mentioned in detailed in next chapter). Through introducing the direct payment policy, government of Japan try to re-activate community activities in the rural area. This direct payment also contains the environmental consideration in addition to the farmland abandonment issue. The direct payment for hilly mountainous area is aiming at reduction of abandonment and prioritizes promotion of community's collective

activities and increasing disaster prevention functions of farmland. It is the main difference of Japanese type of direct payment that it prioritizes promotion of community activities compared to European countries' policy. Through these transitions of aims of rural development policies, Japanese rural development policy is pursuing sustainability by securing farmland functions and fostering community capacity.

Although people understand the importance of farmland and its multi-function, the individuals might not be engaged in maintenance activities voluntarily because such natural local resources are recognized as public goods. It means that even if we have recognized that farmland should not be abandoned for benefits of our society, we still need incentives to be engaged in maintenance activities. The direct payment plays role of such incentives for encouraging farmers to participate to more community collective activities. At the same time, community's capacity, here we say social capital (S.C.) plays an important role in order to sustain farmland preservation activities.

The potential power of community capacity to internalize the "negative externalities" such as degradation of rural area could be seen in farmland preservation activities along with implementation

of direct payment. Threaten of farmland abandonment could be seen in decreasing productivities, disaster damage and losing local opportunities. These threaten directly affect on livelihood of the local residence. Therefore, community capacity must have some impacts on quality of farmland conservation activities in order to maintain their own land for better livelihood. For instance, according to Swinton, where community organizations are actively working, the members help each other to overcome threaten of degradation of farmland, because community collective activities can efficiently realize better livelihood compared to the community without such organizational activities. They know it can bring benefits for whole community (Swinton 2000). Such community capacity is not only brought by within the community but also by interaction between the local and outsiders (Ostrum 1990). Motivating community organization has also a key factor to foster more community capacity and brings sustainable development in the long-term perspective. Direct payment policy is playing role of provision of motivation to local people. So we suppose that the framework of direct payment policy of Japan allows us to mobilize local resources and S.C. for a vital economy, social inclusion and a healthy ecosystem in rural area.

It could be also supported by one of rural development theory called neo-endogenous rural development theory by Ray (2006). He discussed in this theory that for rural development, bottom-up trajectory and locality were necessary which used to be emphasized in endogenous rural development. The “neo” part contains 1) importance of territorial integration and natural resource conservation as community asset 2) some type of intervention in the form of rural policies, 3) stakeholders of both inside and outside of the community in public and private sector as stakeholders of the development (Ray 2006). He developed this theory within framework of LEADER (Liaisons Entre Actions de Devéloppment de l’Economie Rurale) project in EU countries as one of rural economic development. The LEADER emphasizes the importance of various actors in the community, so called LAG (local action group) and potential of local resources (Kajita 2012). In the LEADER projects, it was indicated that capacity building of partnership and its regulation on LAG are necessary for bottom-up and endogenous development which induces sustainability. Shortall and Shucksmith (1998) mentioned that it was necessary to have skills of LAG on integrated leadership and diversity of local ability for sustainable rural development in the LEADER project (Shortall

and Shucksmith 1998). Thus, importance of community capacity on rural development has been argued in the studies on LEADER project in European countries. In this stream, Ray developed neo-endogenous development theory to integrate these arguments systematically. He pursued strategy of guiding stakeholders to accumulate quality of local resources as essence of neo-endogenous rural development theory.

The direct payment is aiming at territorial integration as community assets and natural resource conservation. It encourages community capacity development in order to sustain the conservation activities. From this point of view, under this theory and arguments of neo-endogenous theory, the purpose of Japanese type of direct payment can be substantiated with what the theory tries to emphasize.

1-2. Purpose of Study and Contribution of the dissertation

As mentioned above, we recognize that there is a relationship between multi-function of farmland and community capacity and sustainability. However, discussion on the relevance is few especially with empirical studies and definition of the multi-

function of farmland and sustainability is broad in general. Therefore, this dissertation tries to specify the multi-function of farmland and role of community capacity through literature reviews in order to discuss how these are linking with sustainability. Then, through two essays of empirical studies, it is trying to clarify the effect of direct payment for hilly mountainous area of Japan and community capacity on farmland conservation in order to investigate what kind of maintenance activities are necessary. Furthermore, it is trying to verify the theory of neo-endogenous rural development with findings of studies if the results are relevant with the theory mentioned as the key factors for sustainable rural development. Through this process, this dissertation trying to find out the importance of multi-function of farmland and community capacity, and clarify the relationship between multi-function of farmland and community capacity and sustainable rural development. It can contribute to discussion of academic field of sustainable rural development regarding of farmland conservation.

There are various studies focusing on the rural development and community role, but in this dissertation, it is trying to achieve the purpose with empirical studies using econometric models of two essays. The findings and arguments from this research would

contribute to discussion of academic field of sustainable rural development regarding of farmland conservation. Even though rural farmland degradation is accelerating in the world, the neo-endogenous development theory has not developed well. This dissertation also contributes to the theory development by findings of empirical analysis which substantiate neo-endogenous rural development theory indicating key factors for sustainable rural development.

1-3. Structure of the thesis

In this research, firstly, effectiveness of the direct payment for hilly mountainous area is examined. It examines if the policy was effectively implemented and also what factor was influenced into the restrained abandonment. Secondly in the age of climate change, we focused on the efficiency of the direct payment through disaster mitigation function of farmland. If the payment was implemented efficiently, disaster damage cost could be mitigated. We also would like to see if the community collective activities have impacts on the mitigation of damage cost. Finally, we focus on the social capital in the rural community that what kind of social capital is influencing into results of conservation activities. Through these studies, we are able to bring contribution to discussion and policy

implications for sustainable rural development. This thesis is consisting of 5 chapters as below.

Chapter 1. Introduction is giving the idea how the sustainable rural development is argued in this dissertation. In Chapter 2. Literature review is giving detailed current situation of related terms, findings and arguments and how these are linked with this dissertation. Chapter 3. The Effect of Direct Payment on the Prevention of Farmland Abandonment: The Case of Hokkaido Prefecture in Japan and Chapter 4. Efficiency of Payment for Ecosystem Services (PES) on preservation of farmland in the age of Climate Change – Case study of Japan are essays on the related topic and Chapter gives Policy implication, conclusion and future study. Chapter 5 gives whole conclusion and implication.

Chapter 2. Literature Reviews

2-1. Farmland Abandonment

The marginalization of farmland refers to the decline of farmland profits or rentals for certain types of land use (Li & Li, 2017). Agricultural abandonment is an extreme outcome of marginalization. The rural migration induced by urbanization and industrialization leads to the abandonment of marginal farmland. In developed countries, farmland abandonment has been major trend in agricultural land-use (MacDonald et al., 2000). Farmland abandonment is a complex process interlinked with economic, environmental and social evidence such as depopulation, an aging society, low productivity, migration and food supply self-sufficiency and some of the complex factors among them. According to MacDonald and Crabtree, abandonment occurs due to low productivity in small plots and steep slopes. Low productivity often makes the farmers face low income and disadvantages that reduce their willingness to continue agronomy.

Farmland abandonment can be observed in many countries such as Europe, South Korea, Japan and in developing (Deng, Xu, Zeng, & Qi, 2019). The reasons of farmland abandonment are

multi-dimensional, and significant numbers of studies are investigating drivers of farmland abandonment. According to Terras and Scacchiafichi et al., the divers of farmland abandonment can be categorized as follow ; natural constraints, land degradation, socio-economic factors, demographic structure, and the institutional framework or ecological, socio-economic reasons and reasons related to unadopted agricultural systems (Terres et al., 2015). This dissertation mainly focuses on natural constraints, demographic structure and socio-economic reason, but all these categories are interlinked each other.

The situations are likely created by scattered small plots of farmland, less favored land condition such as steep hill and mountain and also caused by difficulties in producing adequate yields with common cultivation practices (Kim & Arnhold, 2018).In the table, it is summary of the causes of farmland abandonment by region. The causes are seen not alone but with complex intersected situation. These causes are identified since more than 30 years ago. The situation continues to worsen due to recently accelerating of the aging population and declining labor force in the rural communities.

Table 2.1. Farmland Abandonment by region and causes

Region	Land	Causes	Reference
Northeastern Spain	Mountain	Depopulation, migration to urban	(Melendez-Pastor, Hernández, Navarro-Pedreño, & Gómez, 2014)
Mountain Swiss	Mountain	Depopulation, increase of part-time households	
South Korea	Mountain	Depopulation, aging problem Almost 60 percent were 60 years old or above	(Fung, 2017)
Japan	Hilly, Mountain	Depopulation, aging problem, low productivity the determinants are spatially varied among regions	(T. Takayama, N. Hashizume, & T. Nakatani, 2018) (Su, Okahashi, & Chen, 2018)

In Japan, according to Ministry of Agriculture, Forestry and Fishery (MAFF), the farmland that has been marginalized to abandonment is viewed objectively as unable to be used for growing crops with conventional farming methods. By 2015 in Japan, 72% of the marginal mountainous area (consist of 390,000 ha) had been abandoned and the self-sufficiency of agricultural products dropped to 39% and continues to decrease (MAFF 2014). MAFF states that farmers have abandoned the farmland in marginal mountainous areas due to unfavorable conditions that involve hard work, low productivity and additional farming costs compared to the flat land. A continuation of this trend can lead to more isolation and the marginalization of a vulnerable rural population. It can also unbalance the population structure, the loss of traditional knowledge and the value of the community. Out-migration from the rural area can decrease the social welfare and impede sustainable rural development.

According to Fung, the farmland in South Korea was 2297.5 ha in 1970, but by 2003, it had decreased to 1846 ha. Regarding the farming population structure, around 60 percent were 60 years old or above (Fung, 2017). It means that the agricultural sector in Korea is facing an ageing problem.

Negative consequences of farmland abandonment are seen not only dropping self-sufficiency rate of agricultural production, but also in loss of disaster prevention function and loss of traditional community forms as used to see in strong connection within community in rural area of Japanese. For instance, higher farmland abandonment after floods and debris flows are associated with damaged land and irrigation networks in south of Mount Aso in Japan(Sidle, Gomi, Akasaka, & Koyanagi, 2018). Once land was abandoned, it will take long time to recover its function.

Farmland abandonment can be also argued in the context of community forms and asset loss. Rural land is a part of the cultural heritage of the community people. The heritage is considered as a sort of intellectual capital. Although no economic production is considered in general, sustainable preservation of these lands is also having functions on economic significance such as cultural tourism which is growing sector. In this case, life of local people, and the landscapes are the source of this industry (Antrop & planning, 2006). Therefore, to restrain farmland abandonment is important political and economics discussion in regions where they face rural degradation.

Due to these consequences of farmland abandonment, it is threatening sustainable rural development.

As indicated in the neo-endogenous development theory, one of the essential contents of sustainable rural development is the importance of territorial integration and natural resource conservation as community asset (Ray, 2006). Therefore, it is important to verify the measurements and effect The marginalization of farmland refers to the decline of farmland profits or rentals for certain types of land use (Li & Li, 2017). Agricultural abandonment is an extreme outcome of marginalization. The rural migration induced by urbanization and industrialization leads to the abandonment of marginal farmland. In developed countries, farmland abandonment has been major trend in agricultural land-use (MacDonald et al., 2000). Farmland abandonment is a complex process interlinked with economic, environmental and social evidence such as depopulation, an aging society, low productivity, migration and food supply self-sufficiency and some of the complex factors among them. According to MacDonald and Crabtree, abandonment occurs due to low productivity in small plots and steep slopes. Low productivity often makes the farmers face low

income and disadvantages that reduce their willingness to continue agronomy.

Farmland abandonment can be observed in many countries such as Europe, South Korea, Japan and in developing (Deng, Xu, Zeng, & Qi, 2019). The reasons of farmland abandonment are multi-dimensional, and significant number of studies are investigating drivers of farmland abandonment. According to Terras and Scacchiafichi et al., the divers of farmland abandonment can be categorized as follow ; natural constraints, land degradation, socio-economic factors, demographic structure, and the institutional framework or ecological, socio-economic reasons and reasons related to unadopted agricultural systems (Terres et al., 2015). This dissertation mainly focuses on natural constraints, demographic structure and socio-economic reason, but all these categories are interlinked each other.

The situations are likely created by scattered small plots of farmland, less favored land condition such as steep hill and mountain and also caused by difficulties in producing adequate yields with common cultivation practices (Kim & Arnhold, 2018). In the table, it is summarized of the causes of farmland abandonment by region. The causes are seen not alone but with

complex intersected situation. These causes are identified since more than 30 years ago. The situation continues to worsen due to recently accelerating of the aging population and declining labor force in the rural communities.

Table 2.2. Farmland Abandonment by region and causes

Region	Land	Causes	Reference
Northeastern Spain	Mountain	Depopulation, migration to urban	(Melendez-Pastor, Hernández, Navarro-Pedreño, & Gómez, 2014)
Mountain Swiss	Mountain	Depopulation, increase of part-time households	
South Korea	Mountain	Depopulation, aging problem Almost 60 percent were 60 years old or above	(Fung, 2017)
Japan	Hilly, Mountain	Depopulation, aging problem,	(Takayama, Hashizume, &

Region	Land	Causes	Reference
		low productivity the determinants are spatially varied among regions	Nakatani, 2018) (Su, Okahashi, & Chen, 2018)

In Japan, according to Ministry of Agriculture, Forestry and Fishery (MAFF), the farmland that has been marginalized to abandonment is viewed objectively as unable to be used for growing crops with conventional farming methods. By 2015 in Japan, 72% of the marginal mountainous area (consist of 390,000 ha) had been abandoned and the self-sufficiency of agricultural products dropped to 39% and continues to decrease (MAFF 2014). MAFF states that farmers have abandoned the farmland in marginal mountainous areas due to unfavorable conditions that involve hard work, low productivity and additional farming costs compared to the flat land. A continuation of this trend can lead to more isolation and the marginalization of a vulnerable rural population. It can also unbalance the population structure, the loss of traditional knowledge and the value of the community. Out-migration from the

rural area can decrease the social welfare and impede sustainable rural development.

Negative consequences of farmland abandonment are seen not only dropping self-sufficiency rate of agricultural production, but also in loss of disaster prevention function and loss of traditional community forms as used to see in strong connection within community in rural area of Japanese. For instance, higher farmland abandonment after floods and debris flows are associated with damaged land and irrigation networks in south of Mount Aso in Japan (Sidle, Gomi, Akasaka, & Koyanagi, 2018). Once land was abandoned, it will take long time to recover its function.

Farmland abandonment can be also argued in the context of community forms and asset loss. Rural land is a part of the cultural heritage of the community people. The heritage is considered as a sort of intellectual capital. Although no economic production is considered in general, sustainable preservation of these lands is also having functions on economic significance such as cultural tourism which is growing sector. In this case, life of local people, and the landscapes are the source of this industry (Antrop & planning, 2006). Therefore, to restrain farmland abandonment is important

political and economics discussion in regions where they face rural degradation.

Due to these consequences of farmland abandonment, it is threatening sustainable rural development. As indicated in the neo-endogenous development theory, one of the essential contents of sustainable rural development is the importance of territorial integration and natural resource conservation as community asset (Ray, 2006). Therefore, it is important to verify the measurements and effect of policy on reduction of farmland abandonment in this dissertation.

2-2. Function of farmland to mitigate of disaster

As seen in 2.1, we recognize that one of the multi-functions is the disaster mitigation as one of ecosystem services.

To keep multifunction of farmland is precondition for sustainable development in rural area through conservation of qualities and values of farmland and it is also direction towards sustaining rural economies (Antrop & planning, 2006).

According to Uetake, the decline in farmland area is reducing the capacity of agriculture to provide various ecosystem services(Uetake, 2015). This affects mainly agricultural landscapes and resilience to natural disaster. The reduction of farmland (especially rice paddy fields) and ageing irrigation systems reduce

the capacity to provide resilience to natural disaster, including resilience to flooding. Risks of landslide are also increasing due to the increase of abandoned land. Research in Japan indicates that the rate of landslide occurrence is three to four times higher on abandoned land than on cultivated land (Uetake, 2015).

In the age of climate change, we are facing unprecedented climate pattern especially intensive heavy rain. Due to such unusual rain fall, it causes flooding damage even in the area where it used to have less flooding damage in the past (JapanMeteorological, 2017). According to study of Gerrard and Gardner (2002), they estimated smaller amount of soil loss and land slide were occurred in the paddy and well-maintained irrigation field in Nepal compared to less water managed area (Gerrard & Gardner, 2002). Thus, such well-maintained area plays an important role in prevention of erosion, landslide and flooding. Conversely, we could assume that the loss of such area means losing disaster prevention function.

As mentioned in the introduction, essences of neo-endogenous development were an importance of natural resource conservation as community asset and intervention in the form of rural policies, and stakeholders of both inside and outside of the community. To

keep disaster mitigation function is one of the ways for sustainable rural development.

The direct payment for hilly mountainous area is a measurement to provide this ecosystem services and stakeholder fostering. For sustainable management of local farmland, it is necessary to consider the importance of stakeholders as well. According to Bauer et al. and Vila Subiros et al., it is necessary to promote participatory processes with stakeholders (Bauer, Wallner, & Hunziker, 2009; Lasanta, Nadal-Romero, Arnáez, & Policy, 2015). Bauer said that it is necessary to empower stakeholders during land management process for the efficiency and success. This was proved by Buchecker and Hunziker, that consensus building process contributed to improve regional collaboration. The increase of agreement among stakeholders could improve their trust and motivation to collaborate. These are an important findings for efficient activities of rural development (Buchecker & Hunziker, 2006). Therefore, importance of community capacity is also required to be verified even in the context of disaster prevention.

It is hard to measure direct payment policy in case of Japan since it does not have clear standard of efficiency such as improvement certain bio diversity or soil condition standards.

However, if we could see that disaster damage cost was mitigated in the area of direct payment implemented, restrained farmland abandonment had some effects on securing multi-function of the farmland which is precondition for sustainable development. Then, it is possible to consider that the payment was used efficiently in the target area. Therefore, sustainable rural development could be observed in the policy implementation for the multi-function of farmland, which is in this case the damage cost mitigation, by direct payment and other community related variables.

2-3. Direct payment (DP) for hilly mountainous area

As we have discussed above, it is necessary to verify the effect of DP and community capacity. Here we would like to introduce DP in detail.

Direct payment for less favored condition area has been started in European countries. Rural degradation used to be seen throughout the world, so European countries as well. They have direct payment policy long before the Japanese implementation. Among the 15 EU countries, 48% of agricultural lands are conditioned as less favored land for farming activities due to its characterization with high altitude and slope, poor soil condition, poor water access and

limited crop production (Renwick et al., 2013). Therefore, these EU countries introduced a direct payment policy in 1975 as an instrument to gauge the rural development of less favored land and continual support to sustain the rural community(MAFF). As seen in the table 1, EU countries established Common Agricultural Policy for the fundamental reform process and designed their policy shifting from supporting agricultural price to supporting direct income gap between farmers in LFA and other normal conditions as policy of rural development. It promotes not only securing productivities but also environmental benefits, better rural landscapes, and sustained the competitiveness of rural areas.

Table 2.3. Agricultural policy in EU countries

Year	Regulations/Reports	
1975	Subsidy for Less-favored area (LFA) such as Mountains, hilly land.	Introduced subsidy for LFA, aiming at preserving environment and rural society
1985	Regulations for Improvement of Agricultural structure	Modification on subsidy for LFA

Year	Regulations/Reports	
1992		Introduced direct payment for income compensation, fiscal burden due to oversupply of agricultural production price support and trade friction with USA
1999	Council of the EU	Integrated as Rural revitalization policy Gave authorization of zoning standard of LFA to each member countries
2003		Decoupling direct payment, providing subsidy w/ or w/o production. Gave authorization of decoupling or recoupling to each member countries.

source: M. Asai and K. Iida. (2018) Country Report Agricultural policy in LFA, Study of Political factors of the transition of Common Agricultural Policy (CAP) Chapter3

Japanese government also shifted drastically the agricultural policy from price support to the direct payment LFA as income compensation since 2000. Japanese agricultural structural reform

used to be behind compared to EU countries. Therefore, the political shifting was criticized as conserving subsistence farmers by the income compensation in the beginning stage of reforming. Then, the new policy was suggested as income compensation which could also induce farming structural reform. Therefore, Japanese type of direct payment was established with targeting to limited farmers (certified farmers) in order to promote structural reform, consolidation of farmland to scale up farmland. It limits target area and farmland, and farmers who engage in agricultural production.

Japan has practiced an agricultural policy of protecting rice production and rice farmers' income since the post-war period. However, the self-sufficiency of Japan dropped from 79% in 1960 to 38% in 2016. Japan was continually losing self-sufficiency and agricultural competitiveness in the international trading market and caused rural depopulation and diseconomy.

It was necessary for the Japanese government to make a drastic shift in their agricultural policy. One of the major movements was implementing direct payments from 2000 to 2004 for marginal mountainous area for the first phase of direct payment for hilly mountainous area. This is the first direct payments in Japanese

agricultural policy history and targets the communities and individuals who are certified farmers, cooperatives and corporations. These stakeholders agreed to practice environmental preservation, maintain agricultural infrastructure and scenery-preserved cropping to receive the direct payments. After the first phase of the policy, in 2005, the government added more detailed measurements for sustainable agricultural activities to reflect the situations in the rural community. They focused more on productivity and community-based farming. The government also reformed the direct payment to expand the target area and activities to cover more communities with a higher proportion of aged farmers. The direct payment policy in Japan highly promotes community-based activities to sustain agricultural activity and rural development in marginal mountainous areas. The community activity is defined by MAFF that it is collective activities by units of community, such as engaging in whole process of agricultural production and also farm related maintenance activities (MAFF 2014). Community-based agreements of direct payment are shared by 98% of all the agreement stakeholders. Only 2% are individual-based agreements (MAFF 2014). Some municipalities don't receive DP even though they are eligible for receiving based on the regional classification

law. According to Hashiguchi, communities where they have the characteristics of smaller scale and steep slope of the rice paddy field, tend to be lower rate of maintained farmland and facility. Even with the inferior conditions for rice cultivation in these areas, they are likely to show as not registered even they are eligible to receive the DP.

This is because the DP is based on the application of farmers or community who apply to the direct payment. The direct payment is provided based on the list of activities on the application form. And to be eligible to receive the payment, the conditions need to be fulfilled. The targeted farmlands are the disadvantage area where they fulfill at least one of the following conditions: 1) has extreme steep of farmland 15 degree of slop 2) small scale 3) temperature of on-season is extremely low (total accumulated temperatures of 2300 degrees during the period of May to October); and 4) has the rate of age 65 years old with more than 40% and the rate of farmland abandonment with more than 8% (Hashiguchi, 2011).

There are studies on the effect of DP to verify how DP is working in other countries. For instance, Keenleyside et al. employed the Common Agricultural Policy (CAP) Regionalized Impact - Rural Development Dimension (CAPRI-RD) model and analyzed the

regional impacts of CAP measures across a wide range of economic, social and environmental indicators (Keenleyside, Tucker, & McConville, 2010). They simulated the model with the estimation for future scenarios of land uses under the CAP with direct payment. They focused on the impact of policies on the risk of land abandonment. Renwick et al. employed the CAPRI (Common Agricultural Policy Regional Impact) model and Dyna-CLUE- (Dynamic Conversion of Land Use and its Effects) model to estimate the changes of land abandonment under 3 scenarios: 1) removal of payment, 2) trade liberalization and 3) a combination of scenarios 1 and 2 (Renwick et al., 2013). According to CAPRI model, mountainous areas tend to be abandoned under all scenarios. Moreover, according to Dyna-CLUE, there were various differences in the land with abandonment and non-abandonment, even along the mountainous area. These lands depend on the landscape of the area such as steep hilly, valley or plateau. Their results indicate that DP has potential to restrain rural economy stagnation through restraining farmland abandonment.

Tsuya and Sugita explored the case of Germany with a qualitative (survey-based) approach (Tsuya & Sugita, 2013). They showed that there is a positive outcome on rural income with the introduction of

direct payment. There are less income disparities between less favored and favored regions of the rural area. Their survey results indicated that 85% of the respondents experienced a difference after the implementation of the direct payment policy and 67% experienced a greater diversification and functions of their farmlands.

Regaining the function of community-based farming and activities are aimed by direct payment in Japan. The effect of policy and community capacity are reviewed by a number of studies with various approaches and perspectives in case of Japan as well.

Yabiki found that the rate of farmland abandonment tends to be lower in the municipalities where there is more community-based farming (Yabiki, 2015). As the direct payment is being revised every 5 years in Japan, Takayama et. al. evaluated the degree of changes of farmland abandonment at each stage of the policy implementation from 2000 to 2010 (Takayama et al., 2018). He found out that there is a positive outcome with the direct payment where the increasing rate of farmland abandonment has been restrained by 0.8% with a direct payment policy during the years 2000 to 2005.

So, we could assume from these previous studies that DP has effects on farmland abandonment and it leads to restrain rural degradation. Therefore, if the rate of farmland abandonment is observed among areas where they received DP, we could confirm that DP has an effect on conservation of farmland which is precondition of sustainable rural development.

However, there are few studies on relationship between the effect of DP and role of community capacity in rural development with quantitative analysis. In this dissertation, we would like to contribute to give insights of the effect and situation of collective activities of the community in rural area through the analysis. Since DP in Japan prioritizes the function of rural community and maintenance of farmland, it is possible to observe a key factor for sustainable rural development through analysis on DP.

2-4. Social capital

Farmland is the basement of agricultural production. It is difficult to separate from market economy and just manage only by governmental support. One of the reasons why farmland has been abandoned was unprofitability of the farming. Since agricultural

production price keeps dropping and it does not produce profit that enables large-scale farm management (Suda, 2003).

However, in long term, it is necessary to have rule of local community for farmland utilization. It means that farmland management should be concerned with community capacity and social capital of the community.

“Japanese type” of DP has the difference with the direct payment systems of the European countries according to Hashiguchi. The main difference is that Japan’s system considers and prioritizes the function of rural communities. The main purpose of this policy is to strengthen collective activities of the community in rural area. Two important objectives of this policy framework are maintaining cultivated land and keeping rural areas in good condition (Hashiguchi, 2014).

Research by Kim and Won (2003) found that older people tended to contribute to an organization’s social capital and women were more likely to possess social capital than men. According to Puttnam (1995), married women, who had the role of mother or wife, had higher social capital These are seen in farming business in rural area generally called 6^{th} industry. Thus, Social capital is one of

determinations of quality and consequences of rural development and revitalization activities. Meanwhile, sustainability can be discussed in following way. For sustainable development in rural area, local resources, community collective activities should be secured. In general, when people have purpose of increasing their own benefit, they take more collective actions in the organization or community. As seen in study of Mbaiwa & Stronza, social capital has increased by community tourism development because the community behaved collectively to improve their individuals' livelihoods (Mbaiwa & Stronza, 2010). Agricultural related activities such as rural community tourism can be placed as ARAs which has benefit enhancing characteristics. Therefore, we could see sustainability in the process of community's achievement which is improving livelihood. In addition, for sustainability, community-based organization/authorized cooperation gradually develops their capacity along with utilization of the local resources. As long as agriculture and related activity are farming business, they try to sustain their business. To do so, they need to maintain their local resources such as farmland and related facilities because it is the important source supplying for their business. This meets what governmental policy tries to do, that is fostering community

capacity through support for community activities. The government has been promoting establishment of certified organization in rural area. The organization is similar to cooperatives, but has more business characteristics.

The issue of social capital and rural revitalization is well recognized in rural development framework. In the context of neo-endogenous model, the capacity of rural community must be enhanced to use local resources and establish network within and outside of the local area. Therefore, it is necessary to clarify how the S.C. is working in the farmland conservation activities in order to substantiate relation between S.C. and sustainability.

2-5. Multi-function of Farmland in Japan

As mentioned so far, multi-function of farmland is maintained through agricultural activities, efforts of community and government. The multi-function is not just maintained automatically as a result of the agricultural production activities, but it is maintained by efforts of community and intervention of government since it is dealt as one of agricultural environmental public goods. It has broad definition in Japan. Through the literature reviews above, multi-function of farmland can be defined as table 3.

Table 2.4. Multi-function of farmland

Category	Functions
Agricultural issue	Agricultural production, water supply,
Environmental issue	Flooding prevention, soil erosion prevention
Culture and History	Culture tradition inheritance, Community's livelihood, rural tourism resources

Now, we need to think how these functions are maintained and how the policy works. In order to find out the discussion on these issues, the importance of functions showed in the table 3 are verified in this dissertation. Then, we try to explain the relation between these important functions and sustainability which would include policy implications.

Chapter 3. The Effect of Direct Payment on the Prevention of Farmland Abandonment

3-1. Introduction

Farmland has multifunctionality, such as preventing flooding, soil erosion and heat, maintaining river streams and provisions of ground water, and providing social and cultural community well-being. All of these functions are essential for sustainable rural development; however, the multifunctionality of farmland is decreasing worldwide due to farmland abandonment. Abandonment of farmland is also of concerned to policy-makers because of the decreasing values of the agricultural community, infrastructure losses and the decreasing opportunity for tourists and recreation (FAO, 2006). This continuous trend can lead to more isolation and the marginalization of a vulnerable rural communities. It can also unbalance the population structure, the loss of traditional knowledge and the value of the community. Out-migration from the rural area can decrease the social welfare and impede sustainable rural development. Therefore, the consequences of farmland abandonment are closely linked with wider issues of stagnation in rural development and the economy.

Land abandonment is a complex process interlinked with economic, environmental and social evidence. Various factors can be influenced by neglecting farmland and their functions, such as depopulation, an aging society, low productivity, migration and food supply self-sufficiency. According to MacDonald (MacDonald et al., 2000), abandonment occurs due to low productivity in small plots and steep slopes. Low productivity often makes the farmers face low income and disadvantages that reduce their willingness to continue agronomy.

Senda (Senda, 1998) had already concerned that there would be necessity of measurements depending on the regional characteristics in 1990s referring farmland abandonment issues. He said that there are multi-dimensional causes for farmland abandonment. The behaviors of farmers are not defined by centralized mechanism, but still there are some commonly seen situations in the world in rural area. It is seen that withdrawal from land maintenance, lack of new entrants due to aging population. In addition, these situations are likely created by scattered small plots of farmland, less favored land condition such as steep hill and mountain and economical behavior. The situation continues to worsen due to recently accelerating of the

aging population and declining labor force in their rural communities.

In Japan, according to Ministry of Agriculture, Forestry and Fishery (MAFF), the farmland that has been left uncultivated and dilapidated due to abandonment is viewed objectively as unable to be used for growing crops with conventional farming methods. By 2015 in Japan, 72% of the marginal mountainous area (consist of 390,000 ha) had been abandoned and the self-sufficiency of agricultural products dropped to 39% and continues to decrease (Ministry of Agriculture, 2015). MAFF states that farmers have abandoned the farmland in marginal mountainous areas due to unfavorable conditions that involve hard work, low productivity and additional farming costs compared to the flat land. A continuation of this trend can lead to more isolation and the marginalization of a vulnerable rural population. It can also unbalance the population structure, the loss of traditional knowledge and the value of the community. Out-migration from the rural area can decrease the social welfare and impede sustainable rural development.

Due to these consequences of farmland abandonment, it is threatening sustainable rural development.

Keenleyside et al.(Keenleyside et al., 2010) examined the effect of agricultural policies and subsidies implemented in European (EU) countries, such as the Common Agricultural Policy (CAP). They discovered that CAP has successful outcomes in mitigating farmland abandonment. The direct payment (DP) policy is one of the agricultural policies practiced in Japan aimed at rural revitalization through community-based activities to prevent farmland abandonment. This study quantitatively examines how the DP policy has an effect on farmland abandonment in the Hokkaido prefecture in Japan. The Hokkaido prefecture is chosen because of its large share of the agricultural production area. The panel data analysis for three periods (2005, 2010 and 2015) is employed to observe the dynamic changes of the farmland area.

3-2. Agricultural Policy and Rural Development

3-2-1 Common Agricultural Policy (CAP) in European countries

Among the 15 EU countries, 48% of agricultural lands are conditioned as less favored land for farming activities due to its characterization with high altitude and slope, poor soil condition, poor water access and limited crop production (MAFF). Therefore, these EU countries introduced a DP policy in 1975 as an instrument

to gauge the rural development of less favored land and continual support to sustain the rural community(Comission, 2011). Their mission is to continually utilize these lands for agricultural use and maintain their agricultural system with environmental conservation (Keenleyside et al., 2010).

The United Kingdom (UK) was the first country to adopt DP to promote agricultural activity in mountainous areas where it is difficult for the farmers to efficiently produce their crops. France also framed their DP policy, following the UK cases, in the regions of the Pyrénées and the Alps. As this policy became popular among the EU countries, an additional goal was set for rural areas facing depopulation. Therefore, EU countries established CAP for the fundamental reform process and designed their policy from supporting price and production to supporting direct income and rural development. This reform process with CAP and the DP scheme, called Agenda 2000, also provided environmental benefits, better rural landscapes, and sustained the competitiveness of rural areas (Comission, 2011).

3-2-2 Agricultural policy with direct payment in Japan

Japan has practiced an agricultural policy of protecting rice production and rice farmers' income since the post-war period.

However, today, the demand for rice has decreased, even with the continual increase in rice production. Although government is concerned about the continual rice surplus, their agricultural policy has not been fully committed to controlling the rice production and promoting other agricultural crops production (Yamashita, 2004). Therefore, the self-sufficiency of Japan dropped from 79% in 1960 to 38% in 2016. A decreasing self-sufficiency meant inducing more imports of agricultural products and raising food security issues. The policy for the structural innovation of the farmland was long delayed and limited the progress of consolidating small-scale rice farmers to effectively utilize their farmland for other agricultural products. Japan was continually losing self-sufficiency and agricultural competitiveness in the international trading market and caused rural depopulation and diseconomy.

It was necessary for the Japanese government to make a drastic shift in their agricultural policy. One of the major movements was implementing DP from 2000 to 2004 for marginal mountainous area. This is the 1st phase of DPs in Japanese agricultural policy history and targets the communities and individuals who are certified farmers, cooperatives and corporations. These entities agreed to practice environmental preservation, maintain agricultural

infrastructure and scenery-preserved cropping to receive the DPs. After the 1st phase of the policy, in 2005, the government added more detailed measurements for sustainable agricultural activities to reflect the situations in the rural community. They focused more on productivity and community-based farming so that this policy became the 2nd phase of DP. The government also reformed the DP to expand the target area and activities to cover more communities with a higher proportion of aged farmers.

The DP policy in Japan highly promotes community-based activities to sustain agricultural activity and rural development in marginal mountainous areas. The community activity is defined by MAFF that it is collective activities by units of community, such as engaging in whole process of agricultural production and also farm related maintenance activities (Ministry of Agriculture, 2015). Community-based agreements of DP are shared by 98% of all the agreement stakeholders. Only 2% are individual-based agreements. This reflects the current situation that it is difficult to sustain rural development with just the family/individual farmers. Some municipalities don't receive DP even if eligible. This is because the DP is based on the action of farmers or community who apply to the DP. The DP is provided based on the list of activities on the

application form. And to be eligible to receive the payment, the conditions need to be fulfilled. According to Hashiguchi, communities where they have the characteristics of smaller scale and steep slope of the rice paddy field, the lower rate of farmland and facility-maintained area(Hashiguchi, 2011). Even with the inferior conditions for rice cultivation in these areas, they are likely to show as not registered even they are eligible to receive the DP. Moreover, he so addressed that there are various types of land slope, farmland conditions and the rate of aged farmers among the eligible areas. Therefore, it is difficult to quantify the effect of DP. The targeted farmlands are the disadvantage area where they fulfill at least one of the following conditions: 1) has extreme steep of farmland 15 degree of slop 2) small scale 3) temperature of on-season is extremely low (total accumulated temperatures of 2300 degrees during the period of May to October); and 4) has the rate of age 65 years old with more than 40% and the rate of farmland abandonment with more than 8% (Hashiguchi, 2011). Therefore, it is important to consider the sustainable rural development with systematic stimulation of the whole community.

3-2-3 Outline of Direct Payment

Overviewing the history and current situation of the DP in European countries and Japan, Table 1 outlines the linkages and differences among these countries.

Table 3.1. Direct payment overviews

Country	Payment	Purpose	Challenges	Direction
European countries	LFA +Income compens ation	Restrain abandonment, Protection of small-scale farmers.	Still decreasing in the number of farmers. Majority of the farmers are Part-time	Shifting from agricultural policy to Rural development policy =New Entities, rural community development is more focused.
Japan	LFA + income compens ation	Restrain abandonment	Full-time farmers are mainly considered.	Measuremen ts for rapid aging problem, new type of entities in LFA are necessary

*LFA: Less favored area

Source: Norinchukin Research Institute Co.,Ltd. (Hirasawa)

Majority of the farmers are part-time even in the EU, where the structural transformation of agriculture is more advanced. Also, EU agricultural and rural policies are shifting to protecting part-time and small-scale farmers. The role of part-time farmers in agriculture and rural communities, especially in hilly and mountainous areas, is important in Japan as well. Japanese type of DP also needs to be placed by shifting to integrated rural development policy.

3-2-4 Previous studies on direct payment

From the literature on the agricultural policy for DPs, we can divide the research into two types of studies: 1) the impact of the DP policy on the regional economy and landscape and 2) the impact of the policy from the perspective of community-based activity.

Keenleyside et al. employed the CAP Regionalized Impact - Rural Development Dimension (CAPRI-RD) model and analyzed the regional impacts of CAP measures across a wide range of economic, social and environmental indicators (Keenleyside et al., 2010). They used various statistical data in EU countries and simulated the model with the estimation for future scenarios of land uses under the CAP with DP. Because of the possibility of

developing new indicators with CAPRI-RD, they focused on the impact of policies on the risk of land abandonment. Renwick et al. employed the CAPRI (Common Agricultural Policy Regional Impact) model and Dyna-CLUE- (Dynamic Conversion of Land Use and its Effects) model to estimate the changes of land abandonment under 3 scenarios: 1) removal of payment, 2) trade liberalization and 3) a combination of scenarios 1 and 2 (Renwick et al., 2013). According to CAPRI model, mountainous areas tend to be abandoned under all scenarios. Moreover, according to Dyna-CLUE, there were various differences in the land with abandonment and non-abandonment, even along the mountainous area. These lands depend on the landscape of the area such as steep hilly, valley or plateau. Their results indicate that the removal of the policy may cause more land abandonment and may lead to rural economy stagnation.

Tsuya and Sugita explored the case of Germany with a qualitative (survey-based) approach. They showed that there is a positive outcome on rural income with the introduction of DP (Tsuya & Sugita, 2013). There are less income disparities between less favored and favored regions of the rural area. Their survey results indicated that 85% of the respondents experienced a

difference after the implementation of the DP policy and 67% experienced a greater diversification and functions of their farmlands.

Regaining the function of community-based farming and activities through DP in Japan is reviewed by a number of studies with various approaches and perspectives. Yonezawa (Kenichi Yonezawa & Kazuhiko Takeuchi, 2003) claimed that it is necessary to utilize DP to maintain the farmland, especially in the less favored areas. Yabiki found that the rate of farmland abandonment tends to be lower in the municipalities where there is more community-based farming (Yabiki, 2015). As the DP is being revised every 5 years in Japan, Takayama evaluated the degree of changes of farmland abandonment at each stage of the policy implementation from 2000 to 2010 (T Takayama & T. Nakatani, 2011). They found out that there is a positive outcome with the DP where the increasing rate of farmland abandonment has been restrained by 0.8% with a DP policy during the years 2000 to 2005.

There are a limited number of studies on the effect of a DP policy for the prevention of farmland abandonment within the context of community-based functions and sustainable rural development. Most of agricultural policies have been introduced

based on advanced countries in EU. However, we have to consider its historical contexts which are very different. Therefore, it is necessary to accumulate empirical studies of DP policy in Japan. Therefore, the objective of this study is to investigate the impact of DP on rural revitalization through community-based farming. The DP policy in Japan was implemented in 2005 and subsequently reformed with more concentration on community-based activities. Using the census data of 2005 to 2015, this study evaluates the rate of farmland abandonment before and after the policy implementation. The Hokkaido prefecture is chosen due to its large share of agricultural area in Japan that is experiencing a stagnation of agriculture and rural economy. This study will employ agricultural and forestry census data (conducted every 5 years by MAFF) and conduct empirical analysis to find the factors that are associated with the rate of farmland abandonment in Japan.

3-3 Data and Methods

This study investigates the transition rate of farmland abandonment from 2005 to 2015. The census data from agriculture and forestry in 2005, 2010 and 2015 are used for the analysis. Figure 1 shows the agricultural land classification of the Hokkaido

prefecture, and the rate of farmland abandonment in the Hokkaido area from 2005 to 2015 is illustrated in Figure 2. The rate of farmland abandonment in the Hokkaido prefecture is relatively low compared to the national average; however, hilly and mountainous areas have a higher rate of abandonment due to their unfavored conditions.

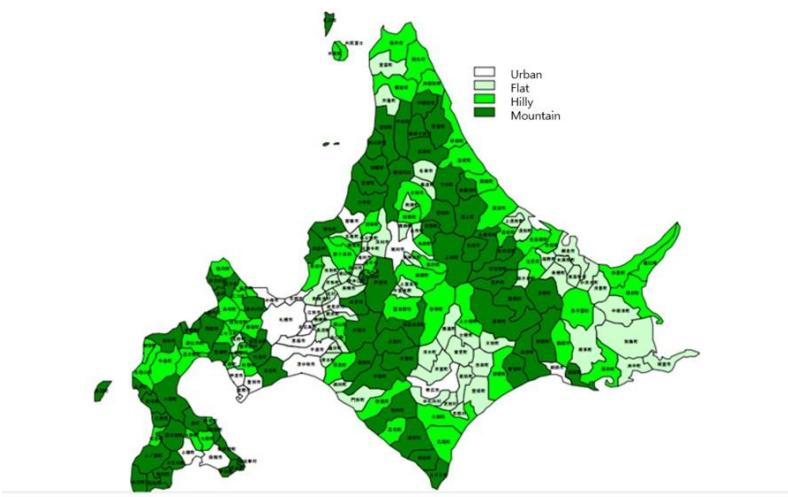

Figure 3.1. Agricultural land Classification of Hokkaido Source: MAFF (Blank area means no data available).

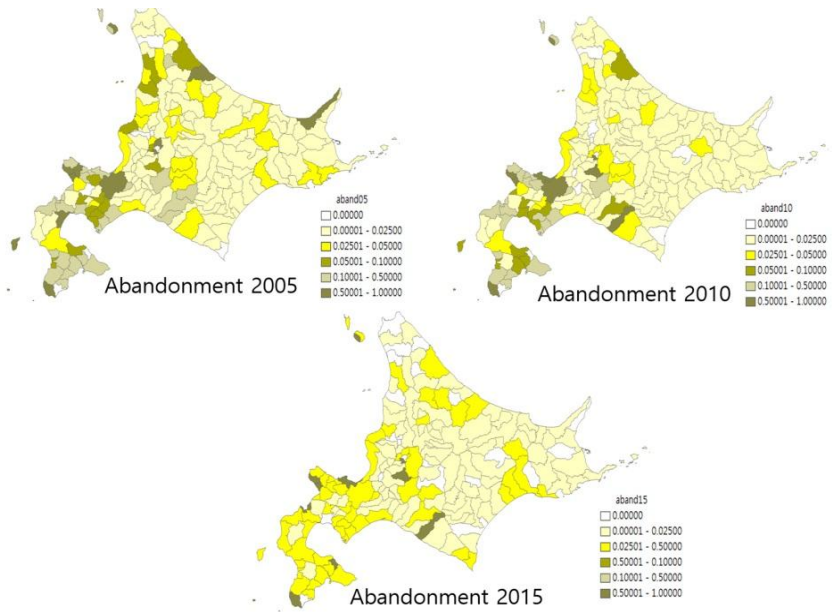

Figure 3.2. Rate of farmland abandonment in Hokkaido (Blank area means no data available).

As discussed in the introduction, continuous trend of farmland abandonment can lead to more isolation and the marginalization of rural communities. Out-migration from the rural area can decrease the social welfare and impede sustainable rural development. Therefore, the consequences of farmland abandonment are creating barriers against sustainable rural development. Therefore, we used rate of farmland abandonment as dependent variable to see the effect of direct payment policy for hilly mountainous area. The

effective policy implementation would lead sustainable farmland management meaning sustainable rural development. For independent variables, we used characteristics of community such as rate of 65 years old and more farmers, the number of farmers. Rate of part time farmers, area and non-farmers owing farmland were added since we have limitation of data, we are not able to utilize profit related data. Instead of profit related data, we use these variables as expressing production of the area. In addition, to control characteristics of heterogeneity of each area, we include land type, crop type and budget of the DP.

Data set is taken in municipality level. Among 212 municipalities in the Hokkaido prefecture, 180 municipalities are the target of the DP policy. Some of the municipalities need to be excluded in the data set due to the limited data of the abandonment area. Therefore, 164 municipalities are used for the analysis. Since not all the municipalities participate in the DP policy, the groups are divided into 1) treated-group (targeted and participated) and 2) controlled-group (targeted but not participated). The treated group consists of municipalities which contains “targeted area and participated community” in the municipality, and controlled group consists of municipalities which contains “targeted area but no

community participated". Although one municipality might contain only one community participation, it is treated group. It would be better to use community level data, but some of the data of variables are not available in the community level. Also, we confirmed the effect of other direct payment policy estimated by Komiyama and Ito with utilizing municipal level data (Komiyama & Ito, 2017). Therefore, we also utilize data of municipal level. Here we face selection bias since even though some are eligible for applying, they did not apply. The choice is based on the community or individuals. According to MAFF, it explains the reason of "not participate" that the area is used to have extremely steep slope so they do not continue farming. The other reason is because of age over 80 years or more. It is difficult to control selection bias by adding control variables only. Therefore, we need to use propensity score matching to control this bias (Austin, 2011).

3-3-1 Analysis Method

The fixed effect approach for the panel data can effectively control for measured and unmeasured time-invariant differences across the municipalities over time. This approach, with interaction variables of year dummy "BA" (comparing outcome of year 2005 and 2015) and group dummy "treated" can provide more robust

estimation for the effect of DP on the rate of farmland abandonment. A simple comparison of the before (in 2005) and after (in 2015) effect of the policy implementation may not provide a clear explanation. There may be other factors that can influence the farmland abandonment of the study area. To alleviate such biases, two groups of targeted municipalities ("participated" and "not participated") for the DP policy are compared for the period of 2005 to 2015.

This approach provides the effect of farmland abandonment by observing and comparing convergence patterns between the treated-group and controlled-group before and after receiving the DP. The role of DPs is identified by the estimated difference in differences (DID) of convergence rates before and after receiving the DP between the two groups of the targeted area. However, due to data limitation using the census data, it is difficult to observe the parallel trend among the treated and control groups. The estimated results using DID method is unbiased only if the source of selection bias is time-invariant and additive (Khandker, B. Koolwal, & Samad, 2009). As it is mentioned in section 1-1-2 above, there is a similar condition among treated and control group that the difference of receiving and not receiving DP depends on the type of land slope,

farmland condition, and the rate of aged farmers. There can be a potential bias with these factors, but are time-invariant. Therefore, the land type and the rate of aged farmers are included to control such biases and use DID estimator for the analysis.

The dependent variable is the rate of abandonment of agricultural land (= Area of abandonment of agricultural land/ area of abandonment of agricultural land + area of net cultivated land of famers) (Yabiki, 2015). Independent variables are year dummy *BA*, group dummy *treated* (T Takayama & T. Nakatani, 2011; Yabiki, 2015; Kenichi Yonezawa & Kazuhiko Takeuchi, 2003), the number of farmers *numfarmers*, rate of part-time farmers *Parttime* (who engage in businesses or jobs other than their own farming), rate of farmers above 65 years old *over65y*, land type dummy *LD*, and agricultural type dummy *paddyD*. We also used the number of non-farmers who own farmland *nonfarm_land* based on concerning of the MAFF that the increase of non-farmers who own farmland is causing the farmland abandonment (Ministry of Agriculture, 2015). Those who own land tend to avoid lending or selling their land to others because it is likely that these lands were inherited a long time ago. Table 2, 3 and 4 presents the variables that are used in the

analysis, correlation matrix of the variables, and the descriptive statistics, respectively.

Table 3.2. Variables Description

Variables	Description	Reference
sq_ab	Rate of abandonment of agricultural land [Area of abandonment of agricultural land/ area of abandonment of agricultural land+ area of net cultivated Land of famers] (Municipal level)	Agricultural census (municipality level) Yabiki 2015
BA	Year dummy (0 = before new phase of DP (2005), 1= after DP policy implementation (2010,2015))	
Treated	Group dummy (0 =controlled group, 1=treated group), (Municipal level)	Report of Implementation of DP for Hilly mountainous area (Hokkadio municipality data MAFF)
Numfarmers	The number of farmers (Municipal level)	Agricultural census (municipality level) T Takayama & T. Nakatani, 2011; Yabiki, 2015 Kenichi Yonezawa & Kazuhiko Takeuchi, 2003)
Parttime	Rate of part time farmers who engage in businesses or jobs other than their own farming. [part time farmers/ The number of total farmers (Municipal level)]	
over65y	Rate of farmers above 65 years old (Municipal	

Variables	Description	Reference
	level) [the number of farmers above 65 years old/ The number of total farmers]	
LD	Agricultural land type dummy (0=flat land, 1=not flat, mountainous area) (Municipal level)	Agricultural region classification (MAFF)
paddyD	Agriculture type dummy (0=not paddy field, 1= rice paddy field) (Municipal level)	Agriculture type classification (MAFF)
Nonfarm	non-farmer owing farmland (Municipal level)	Agricultural census (municipality level)
Budget	Budget of the policy (Municipal level)	Report of Implementation of DP for Hilly mountainous area (Hokkaido municipality data, MAFF)
Rent	rate of farmland lease (Municipal level)	Agricultural census (municipality level)

Table 3.3. Correlation matrix of the variables

	Numfarmers	Parttime	over65y	nonfarm	LD	PD	Budget	rent
Numfarmers	1.00							
Partime	0.15	1.00						
over65y	0.06	0.41	1.00					
nonfarm	-0.01	0.08	-0.06	1.00				
LD	-0.32	0.09	0.11	-0.02	1.00			
paddyD	0.30	0.30	0.12	0.12	-0.23	1.00		
Budget	0.03	0.03	0.01	-0.04	0.03	-0.01	1.00	
Rent	-0.04	0.01	0.22	0.06	0.15	-0.07	-0.02	1.00

Table 3.4. Descriptive statistics.

Variables	Controlled group		Treated group	
	Mean	**S.D.**	**mean**	**S.D**
Aband	0.018	0.02	0.033	0.053
sq_ab	0.2101	0.2	0.117	0.089
Numfarmers	259.7	183.8	310.3	282.8
Parttime	0.336	0.115	0.339	0.137
over 65y	0.378	0.134	0.353	0.123
nonfarm_land	122.6	145.8	91.88	104.0
LD	0.543	0.499	0.660	0.475
paddyD	0.0721	0.259	0.202	0.402
Budget	0	0	94,187	429,341
rent	0.033	0.03	0.034	0.04

DID can estimate the effect of policy without biases, such as individual characteristics of the sample and/or some other factors that may affect the results. The concept of the DID estimator is referred to the studies of Khandker et al. (Khandker et al., 2009). The effect of the policy can be estimated by the following Equation (1):

$$Y_{it} = \alpha + \beta \text{Treat}_{it} \times \text{BA} + \rho \text{Treat}_{it} + \gamma \text{BA} + \varepsilon_{it} \qquad (1)$$

where Y_{it} is rate of farmland abandonment. The coefficient β on interaction term of *participation to the policy* (1=participated, 0=otherwise) $Treat_{it}$, and time BA is the DID effect of the DP policy. It expresses the difference effect before and after the policy implementation. Single γBA is included because there might be situations affecting other variables overtime, which is difficult to capture as variables. By adding time variable BA, so called time effect, we can avoid over/under estimation. Also, we assumed that the time effect of the treated and controlled group for the case of "no DP policy implementation" are in similar condition. Even though we include time effect into the mode, we can control some of the variables which is time-invariant and might affect other variables to avoid biases. That is, the difference of receiving and not receiving DP depends on the type of land slope, farmland condition, and the rate of aged farmers. There can be a potential bias with these factors, but are time-invariant. Therefore, the land type and the rate of aged farmers are included to control such biases and use DID estimator for the analysis.

Based on general framework of the DID, we use the panel fixed effect model because it allows for partially avoid the endogeneity and omitted variable bias [18]. The result of Hausman test indicates there are no correlation between the regressors and errors that allows us to use the panel fixed effect model. It controls not only for the unobserved time-invariant heterogeneity but also for heterogeneity in observed characteristics over a multiple-period setting.

$$Y_{it} = \alpha + \Phi(\text{Treat}_{it} \times \text{BA}) + \rho \text{Treat}_{it} + \gamma \text{BA} + \delta \text{X}_{\text{it}} + \eta_i + \varepsilon_{it} \quad (2)$$

where Φ is the DID estimation in Equation (1), $Treat_{it}$ is the treatment variable of time t and X_{it} is the time-variant variable of each i in time t. δ is coefficient of time-variant covariates, η_i is individual fixed effect. Since $Treat_{it}$ is also individual effect, we can include $Treat_{it}$ into η_i as part of individual effect, by setting $\rho=0$ (Chamberlain, 1978).

$$Y_{it} = \alpha + \Phi Treat_{it} \times BA + \gamma BA + \delta X_{it} + \eta_i + \varepsilon_{it} \qquad (3)$$

In this way, the source of endogeneity which is individual characteristics η_i is dropped by fixed effect and therefore the effect of the implementation Φ can be estimated without such bias.

The group of treated and controlled is decided based on the community / individual's decision making. Therefore, it has endogenous problem. Therefore, we used Propensity score matching weight when we run DID regression.

3-4. Results

Based on the result of Hausman test χ^2=144.72 (p=0.00), the fixed effect model is employed for the analysis. Table 5 shows the result of estimation using the fixed effect model. The effect on farmland abandonment by DP is examined by the interaction variable of group dummy and year dummy, which is expressed as '*treated # BA*'. In Model 1, which considers the effect of DP only, the estimated coefficient of the interaction variable of group dummy and year dummy is -0.02, which means that the DP is reducing the farmland abandonment. Model 2 includes the control variables in the estimation since it is necessary to control the influences of each municipals. The single variable of BA showed negative and statistically significant in both model 1 and 2. After policy implementation (BA=1), rate of abandonment is decreased. The single

variable of treated is omitted because of the fixed effect. The interaction term "*treated#BA*", treated group (*treated*) and year dummy is not statistically significant and negative in model 1, but significant tin model 2. This means that the farmland abandonment was restrained by 0.02% compared to 2005 because of the DP implementation. Therefore, this result tells us that there is the effect of DP on restrain of abandonment.

Table 3.5. Result of the fixed effect model estimation

VARIABLES	Model 1	Model 2	PSM
BA	-0.0222**	-0.0210**	
	(0.0107)	(0.0105)	
Treated	-	-	
BA#treated	**-0.0168**	**-0.0216****	-0.065**
	(0.0129)	**(0.0107)**	
LD		-	
LD#BA		-0.00954	
		(0.0114)	
paddyD		-	
paddyD#BA		0.0124	
		(0.0156)	
Numfarmers		-4.17e-05	
		(3.87e-05)	
Parttime		-0.0351	
		(0.0389)	
over65y		-0.151***	
		(0.0435)	
nonfarm_land		0.000107	
		(0.000106)	
Budget		5.64e-08***	
		(1.23e-08)	
Rent		0.0584	
		(0.0807)	
Constant	0.178***	0.245***	
	(0.00411)	(0.0261)	
Observations	492	484	492
Number of	164	164	164

VARIABLES	Model 1	Model 2	PSM
Municipality			
R-squared	0.111	0.226	

Note: Robust standard errors in parentheses; *, **, and *** are 10%, 5%, and 1%, respectively, and denote that the values are statistically significant

LD#BA shows the interaction term of land type (1=mountainous area) and year is not statistically significant and shows a negative correlation with the farmland abandonment. The abandonment rate of flat land and mountainous area can be observed by categorical variable of *LD* and *BA*. It was recognized that the hilly mountainous areas tend to abandon more than the flat land even with the DP policy. However, due to insignificant results for this variable, other characteristics (i.e. frequency or quality of the community activities) can be considered and assumed to effect from the policy implementation. *PaddyD#BA* is positively correlated with the farmland abandonment and not statistically significant. This result indicates that the paddy fields tend to increase the abandonment rate. However, since the slope and location of paddy field does not provide from the data, it is difficult to conclude the relationship between this variable and the dependent variable. If the land condition of agricultural type can be observed, more clear results can be presented from the analysis. The number of farmers is negatively correlated but not statistically significant. It is likely that farmland abandonment can increase as less farmers are involved in agricultural activities which is consistent with the study of Takayama and Nakatani (T Takayama & T. Nakatani, 2011).

The result of *over_65y* is statistically significant. This result indicates that the rate of abandonment can be restrained if there are more 65 years and over farmers in the community. The aging society can be related to the high percentage of the population with 65 years and over in generally thinking. However, we interpreted that in the case of farmland abandonment in rural

community, the farmers with ages of 65 and over are the key for effective use of the DP. This result can be explained since older farmers have been engaged in agricultural activities throughout their lives and have been well engaged in community cooperation and activities. Therefore, community maintenance and cooperation have been an important priority in their lives. With the DP policy, they will have a higher motivation to better preserve their farmlands. In the studies of Takayama and Nakatani (2011), they also demonstrated that over 65 years old famers have a positive influence on the mitigation of farmland abandonment. The lower opportunity costs of farmers 65 years and over compared to the younger generation is one of the reasons they found that older farmers are more involved in community activities including the maintenance of farmland with DPs. Furthermore, as point out in the study of Ito et al. (2019), the crowding-out effect of the motivation for participation is likely to emerge when the participants consider external intervention as controlling by someone else (Ito, Feuer, Kitano, & Asahi, 2019). It is considered that the DP is unlikely to influence the crowding-out effect on conservation of the farmland. Because it is largely supportive by existing institutions of community-based farming, the participation is voluntary and based on the discretion and shared responsibility of community members.

The result of *nonfarm_land* is consistent with the statement from the MAFF report that the increase of non-farmers who own farmland is causing the farmland abandonment. Those who own land tend to avoid lending or selling their land to others because it is likely that these lands were inherited a long time ago. The budget is not statistically significant. This can be explained with the same reasons as the number of farmers: it would be important to place emphasis on quality of measurement rather than the quantity.

The result of *budget* is statistically significant and positive. Only the amount of the budget of the DP cannot make the change on the rate of abandonment and it might be relatively bigger in the area where it has serious area of abandonment and became large budgets. The result of *rent* is not statistically significant and positive. This result can be explained, with the effect of farmland lease, where the MAFF is expecting that the increase of non-farmers who own the farmland can cause the increase in the farmland abandonment. However, these cases have not been observed yet and, due to the higher transaction cost for renting, the farmers hesitant to actively renting out their farmland (Deininger & Jin, 2005).

Table 3.6. Result of Probit model for propensity score on treated/controlled group

VARIABLES	treated/controlled group
Numfarmers	-0.001**
Parttime	-0.220
over65y	0.368
nonfarm_land	0.004**
LD	-.661***
paddyD	-.840**
rent	0.4368
Constant	0.276
Number of Municipality	164
Pseudo R2 = 0.0923	
Log likelihood = -101.58402	

Still, we face selection bias since the choice of participate and not participate is based on the community or individuals even though some municipalities are eligible for apply. Therefore, we estimated propensity score by Probit model to estimate the differences of treated and controlled group. After controlled endogenous problem, the effect of policy by DID is negative and statistically significant. It means that abandonment was 0.065% restrained in the treated group after controlled selection bias.

As we mention, all the samples in both treated and controlled group are eligible for receiving the direct payment. However, some reasons make them to choose “not participate” in though they are eligible. To estimate the reasons of allocation to treated or controlled group, we estimated propensity score by Probit model. Table 6 is the result of the Probit model to estimate correlation between participate or not participate to direct payment. The number of farmers is negative and statistically significant. It means that if farmers are less in the municipality, it tends to not participate, meaning tend to be controlled group. It is possible to say that if the municipality cannot secure the number of farmers, it can be obstacle of participate to the direct payment. The non-farmer who own farmland is positive and statistically significant. It is one of the major concerns that increase of non-farmers who has ownership of farmland causes farmland abandonment as MAFF reported. Therefore, it is possible that the municipality where it has higher number of this cohort tends to participate the direct payment policy to take measurement with community collective activities. Land dummy LD and paddy field dummy paddyD are negative and significant. Where they are flat and non-paddy tend to be not participated to the direct payment. It might be possible that even though they fulfilled condition of eligible for receiving except slope condition, the flat area tends to choose not participated because this type of land has higher rate of irrigation management than hilly mountainous area. Also, unit price of subsidy for non-paddy farming area is lower than paddy field. Moreover, according to MAFF, non-paddy area are used to work individually in Hokkaido so not used to be engaged in collective work for maintain their land. Therefore, when application form was created by non-paddy farmers, some of them got confused how to plan community collective management activities.

3-5. Discussion and Conclusions

This study estimates the effect of the DP policy on farmland abandonment. The DP is provided for the farmers or the communities who are engaged in agricultural activity and maintain their community.

Even with different historical contexts and practices between Japan and EU, many of the agricultural policies are advanced by the countries in EU. It is important to understand what has been practiced and learn the experiences that have been accumulated in these countries, and to formulate better implementation of DP policy in Japan. This study contributes to the discussion of Japanese type of DP through the estimation of the DP policy effect on farmland abandonment. The DP is provided for the farmers or the communities who are engaged in agricultural activity and maintain their community.

The results of DD estimation indicated that, with the DP policy, the rate of restraining farmland abandonment in the treated group is higher than the rate of farmland abandonment in the controlled group. This is also consistent with the latest study of Takayama, Hashizume and Nakatani (2018), where he mentioned that the less-favored land payments fostered to continue the land use and prevented the farmland abandonment through the maintenance of farm households(T Takayama, N Hashizume, & T Nakatani, 2018). Since this DP has the characteristics of maintaining activities by the communities, it can play an important role to restrain the farmland abandonment more than the individual activities. The farmers in the age group of 65 years or older have negative correlation with the rate of abandonment. Even with the rapid aging society in the rural area, in the case of Hokkaido, the farmers with the age of 65 years or older are more likely to engaged in the community-based activities. Moreover, this cohort can be placed as community asset accumulated since long

time ago. Study of Akamani & Hall (2015) called such assets as past capital. Their study showed that past household capital had a significant positive effect on current capital. Then, the households with higher past capitals have higher capacity to adapt new program by government (Akamani & Hall, 2015). Therefore, when we consider cohort of 65 years or older farmers has higher past capital, they have higher capacity to participate to the direct payment policy. It would be a key factor when the government tries to implement effective intervention for farmland management.

From these results, we could say that a well-organized community or active stakeholders with experiences can be the key factor to effectively use DPs and promote sustainable rural development. We suggest that it is necessary to implement the integration of the scattered farmland into a larger scale of land and to provide the agricultural cooperation or any other type of organization with incentives for more efficient community activity. This can also be a measurement of the absence of landowner with the ownership of farmland, which causes farmland abandonment. A large amount of farmland continues to be abandoned with the lack of inheritors. It is challenging to solve "decrease the number of farmers" and "increase the number of nonfarm households with farmland-tenure" problems, as pointed out in the report of MAFF. In fact, Japanese type of DP has several other schemes such as Payment for multi-function of farmland (MAFF). It is also promoting community collective activities on farmland maintenance. However, if we consider the results of this payment for multi-function of farmland, it might be hard to see the effect because this payment aims at improvement of participations of the farmers or the community in the activities (rate of participation). It could contribute to provide motivation to participants but hard to see the visible result, comparing to the DP for hilly mountainous area regarding of efficient use of the budget.

As mentioned above, to sustain a healthy rural community, it is recommended that the government take actions with a farmland consolidation policy and search for farm management structural innovation support by the policy. The new paradigm to improve the quality measurement in promoting the agricultural activities can be shifted from traditional family farm management to the utilization of agricultural cooperation, the agricultural private company, opening farms to outsiders and expanding the entrustment of agricultural operations. The DP is an important policy that targets community-based practices and encourages the participants to practice more community-based activities and sustain their community. The related arguments are seen in the neo-endogenous development theory as well. It mentioned that it was necessary to have certain capacity building such as integrated leadership and diversification of stakeholders for sustainable rural development for sustainable rural development. The findings of this research brought us insights of importance of well-functioned stakeholders and encouragement for them through the government interventions.

The arguments of this study suggest us that it is important to implement policy with aspect of community capacity building for reduction of farmland abandonment.

For future study, it will be a great opportunity to examine whether the farm management structure affects farmland abandonment and more detailed characteristics of community or regional characteristics/conditions could influence the land abandonment rate.

Chapter 4. Efficiency of Payment for Ecosystem Services (PES) on preservation of farmland in the age of Climate Change

4-1. Introduction

4-1-1 PES and agricultural land in ecosystem

Rural degradation can be observed in many countries such as Europe, South Korea, Japan and in developing countries (Deng, Xu, Zeng, & Qi, 2019), and especially farmland abandonment is increasing rapidly in these decades. The reasons of farmland abandonment are multi-dimensional such as natural constraints, land degradation, socio-economic factors, demographic structure, and the institutional framework or ecological, socio-economic reasons and reasons related to unadopted agricultural systems (Terres et al., 2015). Negative consequences of farmland abandonment are seen not only dropping self-sufficiency rate of agricultural production, but also in loss of disaster prevention function and loss of traditional community forms as used to see in strong connection within community in rural area of Japanese. For instance, higher farmland abandonment after floods and debris flows are associated with damaged land and irrigation networks in south of Mount Aso in Japan (Sidle, Gomi, Akasaka, & Koyanagi, 2018). Once land was abandoned, it will take long time to recover its function. Therefore, it is necessary to maintain rural land as community asset with sustainable management structure and intervention of government.

In the theory of rural development, called neo-endogenous rural development theory, in order to realize sustainable rural development, it emphasizes 1) importance of territorial integration and natural resource conservation as

community asset 2) some type of intervention in the form of rural policies, 3) stakeholders of both inside and outside of the community in public and private sector as stakeholders of the development (Ray 2006). It also says that bottom-up trajectory and locality were necessary which used to be emphasized in endogenous rural development.

We recognize that one of the multi-functions of farmland is the disaster mitigation as one of ecosystem services. As we see in the neo endogenous rural development theory, it is required to take a measurement for farmland conservation and its related activities by community in order to pursue sustainable rural development. Disaster mitigation function can be secured through this farmland conservation program.

4-1-2. PES and agricultural land in ecosystem

Payment for Ecosystem Services (PES) is the payment for ecosystems including farmland and conservation activity that has characteristics of public goods. Farmland is public goods in terms of having multifunction such as provisions of scenery, preventing natural disaster besides providing agricultural products.

Millennium Ecosystem Assessment of UN evaluated that ecosystem service of the farmland such as prevention of natural disaster was deteriorating. And it estimated that the deterioration is accelerating during 21st century. It comes to more crucial issue that we are facing climate change in these decades. Climate Change 2014 Synthesis Report from IPCC indicated that farmland preservation is necessary as approaches for managing the risks of climate change(Pachauri & Meyer, 2014).

One of the most important functions of farmland is prevention of flooding by the land holding appropriate water supply. However, farmland abandonment is accelerating and damage of flooding is getting serious especially in un-favored

land in rural area where they face lack of farmers and degradation of community farming system. As a result, these abandoned areas are vulnerable to natural disaster such as flooding and at the same time, it is connecting to stagnation of community economy and culture which is vicious cycle of creating lack of population. Thus, these areas are experiencing rapid aging and depopulation along with more visible effect from recent climate change.

In order to restrain the accelerating deterioration, PES was brought as one of the solutions in many countries.

Definition of PES is not internationally established but principally, it can be defined by following conditions(Wunder, 2005).

i. Spontaneous trade by supplier and beneficiary of Ecosystem serves
ii. Defined land use or ecosystem related services
iii. Existence of purchaser of ecosystem services
iv. Existence of supplier who manage ecosystem services
v. Sustainable supply of ecosystem services by the supplier (buyer)

Since 1990, PES has been implemented around the world as an effective method of preservation of ecosystem. Under those definitions, in Japan, central government and local government have been implementing PES such as direct payment for hilly mountainous area since 2000 and environmental preservation direct payment since 2011. Although the term of PES is used as various preservation mechanism based on market theory, now in Japan, direct payment for hilly mountainous area is considered as one of the PES. Agricultural production is recognized as positive externality. Management and preservation of farmland and related water supply facilities are directly connecting to disaster prevention function. Therefore, to provid payment for such function could be the payment for environmental services to take measures of market failure, in this case it means occurrence of disaster such flooding due to

degradation of farmland function.

sine this direct payment prioritizes promotion of community activities, we consider the importance of community's stakeholders. In addition, farmers who have been maintained their land for a long time in the community is playing important role as stakeholders on implementation of governmental programs and on sustainable rural development. Therefore, government supports activities of agricultural organization, community farming groups, which is urgent issue. It is crucial to foster farmers not only in Japan but also in other countries where they face lack of farmers.

4-1-3 Importance of farmland preservation activity in the age of climate change

To keep multifunction of farmland is precondition for sustainable development in rural area through conservation of qualities and values of farmland and it is also direction towards sustaining rural economies (Antrop & planning, 2006). However, along with farmland abandonment, the rural community is threatened by disaster damage.

According to Uetake, the decline in farmland area is reducing the capacity of agriculture to provide various ecosystem services. This affects mainly agricultural landscapes and resilience to natural disaster. Total farmland and paddy field area decreased by 12% between 1990-92 and 2010-12 respectively, and abandoned land expanded 1.8 times between 1990 and 2010. The reduction of farmland (especially rice paddy fields) and ageing irrigation systems reduce the capacity to provide resilience to natural disaster, including resilience to flooding. Risks of landslide are also increasing due to the increase of abandoned land. Research in Japan indicates that the rate of landslide occurrence is three to four times higher on abandoned land than on cultivated

land (Tetsuya Uetake, 2015). Taking more than a third of the paddy fields out of rice production and leaving much of it idle has negative implications for providing agri-environmental public goods (Jones & Kimura, 2013). In the age of climate change, risk of extreme rain is increasing more and more.

According to study of Gerrard and Gardner (2002), they estimated smaller amount of soil loss and land slide were occurred in the paddy and well-maintained irrigation field in Nepal compared to less water managed area (Gerrard & Gardner, 2002). Thus, such well-maintained area plays an important role in prevention of erosion, landslide and flooding. Conversely, we could assume that the loss of such area means losing disaster prevention function. For instance, the higher farmland abandonment after floods and debris flows are associated with damaged land and irrigation networks in south of Mount Aso in Japan (Sidle, Gomi, Akasaka, & Koyanagi, 2018). Once land was abandoned, it will take long time to recover its function.

As mentioned above, the essences of neo-endogenous development are natural resource conservation as community asset and intervention in the form of rural policies. To keep disaster mitigation function is one of the ways for sustainable rural development. Therefore, it is necessary to preserve farmland as a function of disaster prevention, and moreover for sustainable rural development. To do so, PES is one of the measurements since farmland is the public goods. In Japan, there are three types of direct payment for environmental conservation on agricultural sector. However, only the direct payment for hilly mountainous area could provide full data of three period of years in the municipality level. Therefore, in this research, we utilize data of this policy for the analysis.

4-1-4 Arguments on PES and efficiency

Meanwhile, the PES is gradually expanding its discussion to its efficiency of the payment since most of this type of direct payment is provided by

government not by private sector (Lankoski, Lichtenberg, & Ollikainen, 2004). OECD and other researches indicated the inefficiency of input based or area based payment (OECD, 2010). As seen in Japanese type of direct payment, the payment is provided based on area (provided some amount per ha) depending on the condition of the land. The government provides direct payment for hilly mountainous to target areas where they fulfill at least one of the following conditions: 1) has extreme steep of farmland 15 degree of slop 2) small scale 3) temperature of on-season is extremely low (total accumulated temperatures of 2300 degrees during the period of May to October); and 4) has the rate of age 65 years old with more than 40% and the rate of farmland abandonment with more than 8%. If the area fulfills one of above conditions, and if the application form by community is approved, the payment is provided based on the targeted area (ha). Existing literatures regarding of cost-effectiveness of direct payment are mainly examined by the result of environmental direct payment. In the US, UK and European countries where they have been implementing "result based" or result oriented payment are examined as below.

Matzdorf & Lorenz found the positive impact of farmer's motivation to reach the environmental goal and to cooperate by result-oriented incentives in Germany (Matzdorf & Lorenz, 2010). Burton and Schwarz examined the strength of results-based direct payment of agri-environmental schemes (Burton & Schwarz, 2013). Lankoski found out that adding environmental targeting to the uniform payment policy improves the cost-effectiveness of uniform payment. His analysis shows that, when targeted payments are implemented, the gains from environmental targeting are large and exceed the increase in policy-related transaction costs(Lankoski, 2016). Tanaka studied the effect of three targeting strategies cost-benefit based, cost based and participation is based payment by using case study of Conservation reserve program in Iowa

US. His model found out that cost-benefit based payment was the most efficient strategy as seen in soil condition (Tanaka, 2015). He discussed that it is necessary to investigate efficient implementation of Japanese type of direct payment as well for environmentally friendly agriculture because current policy does not consider cost and benefit of the policy implementation. Nishizawa (Nishizawa, 2017) reviewed auction type of payment or result based payment in US and European countries. In his discussion, he concluded that Japanese type of direct payment is required more studies and basis of payment should be clarified its relevance. Uetake also mentioned that Payments targeted to outcomes have proven to be more effective in improving the environmental performance of agriculture in other OECD countries. He pointed out that such payments should be considered in Japan.

The efficiency was clarified by results such as improvement of soil condition after farmers activities as reviewed above. However, Japanese type of direct payment is not aiming at specific improvement of items. So, it is hard to discuss efficiency. There are few studies mentioned efficiency of Japanese type of direct payment. Nishizawa mentioned the importance of consideration on the efficiency on Japanese type of direct payment in the discussion part. He said that it was important to consider cost-effectiveness of implementation (Nishizawa, 2017), but very few studies were seen in this issue in Japan. This is because it does not have clear standard of achievement of the payment. In this study we try to investigate if Japanese type of direct payment is efficiently used in terms of securing flooding disaster mitigation function.

We assume following way. One of negative consequences of farmland abandonment was decrease of disaster prevention function. So, if we could investigate that disaster damage cost was less in the target area of the direct payment implementation, we could assume that as the result of the direct

payment, the target area kept farmland function and the well-maintained land contributed to mitigate disaster damage cost compared to the area where has no treatment. If farmland was well-maintained, it could secure disaster prevention function. It also means that the direct payment was efficiently used since we could see it is securing multi-function of the farmland. Of course, there is a limitation to see the effect of farmland conservation on disaster mitigation. Moreover, each farmland has different characteristics and abilities to hold water level which cannot control only by the direct payment. However, still even partially, as long as direct payment has some effects on restraining farmland abandonment, it is possible to say that the payment was used efficiently through observing disaster mitigation condition.

It is important to understand the effect of direct payment so as to improve the cost-effectiveness of agri-environmental policy measures. There are several researches about impact of PES related policy on environmental conservation of farmland in Japan. Uetake and Sasaki (T Uetake & Sasaki, 2016) utilize OECD's environment and economics integration model so called SAPIM to evaluate PES on impact of environment for the first time. They concluded that direct payments can improve soil condition and carbon sequestration. The policy brought different impacts both to farm economics and the environment. Ogawa et.al (Ogawa, Shima, Yoshisako, & Fukumoto, 2005) estimated soil loss under implementation of farmland conservation. They estimated cost of prevention of soil loss will increase when they do not manage their land very well due to lacking of farm management.

4-1-5 Arguments on Stakeholders and Efficiency

In addition to discussion on efficiency of result-based payment, several statements are emphasizing the importance of community capacity for efficient payment seen as social capital. For instance, according to Swinton, where

community organizations are actively working, the member helps each other to overcome threaten of degradation of farmland because community collective activities are efficient compared to the area without such organizational activities and bring benefits for whole community (Swinton, 2000). The experience in Africa on PES paradigms shows that PES is an evolutionary process of landscape management involving diversified stakeholders at local community (Leimona, van Noordwijk, de Groot, & Leemans, 2015). They also mentioned that the interdependency of fairness and efficiency is the main consideration in designing and implementing a PES scheme. The case study of Shiga prefecture in Japan evaluates impact of PES policy. In the findings and conclusion, it was clarified that if community has been accumulating social capital since long time, probability of participation to PES related program is higher. Policy would be effectively implemented by supporting such self-sustained community or farmer's organization (Ito, Feuer, Kitano, & Komiyama, 2018). According to Bauer et al. and Vila Subiros et al., it is necessary to promote participatory processes with stakeholders (Bauer, Wallner, & Hunziker, 2009; Lasanta, Nadal-Romero, Arnáez, & Policy, 2015). Bauer said that it is necessary to empower stakeholders during land management process for the efficiency and success. Therefore, community capacity must have some impacts on quality of preservation activities in order to maintain their own land. To support the establishment of efficient and fair PES schemes, it is necessary to have solutions at each community stakeholder's level in implementing PES schemes. An honest and trusted intermediary is one of the key factors of a successful PES scheme.

4-2. Purpose of study

In our study, we would like to examine the influence of direct payment for farmland preservation on disaster damage cost at municipality level of Hokkaido prefecture in Japan so that as we assumed above, we could observe efficiency of the direct payment. Hokkaido is the lowest rate of farmland abandonment in Japan, but still observing rapid degradation of farmland and vulnerability toward climate change. It could be reference for other regions in the world where will face the same problem that Japan has been through. Also, we would like to see if the community capacity has some impacts on disaster mitigation, we could make suggestion for other regions where they face the same threaten of farmland degradation and disaster damage.

Japanese type of direct payment for hilly mountainous area could be one of the PES because by the payment, it is possible to mitigate disaster. Based on the studies by Yonezawa & Takeuchi Keenleyside et al, Renwick and Takayama and so on, we could assume that direct payment has some effects on restrain of farmland abandonment (Keenleyside et al., 2010; Renwick et al., 2013; T Takayama & T Nakatani, 2011; K Yonezawa & K Takeuchi, 2003). Therefore, if direct payment for hilly mountainous area (=PES) is efficiently used, damage cost of flooding would be likely lower than the areas where they don't receive direct payment.

2 Data and Methods

4-3. Data and Methods

We use panel data of 2005, 2010 and 2015 on precipitation data and Agricultural Census. The variables are listed in the table 1. We are utilizing data of damage cost of flooding as explained variable. Damage cost was taken

from flooding statistics. For this analysis, it includes damage costs on houses, office, and agricultural land due to extreme rain. Agricultural production was excluded because it might bring biases on damage cost because it affects farmers' behavior. The direct payment for hilly mountainous area has been implemented for more than 10 years which is long enough to see the effect as independent variables compare to other direct payments that just started or no data available in municipality level. We assume that if direct payment was provided efficiently, the disaster damage cost is likely lower. Therefore, as explanatory variables, we use dummy variable of direct payment received or not in municipal level. It is worth note that qualification of the participants to the DP is based on regulation, and community unit is the majority participants.

We also use precipitation variable as explanatory variables to see correlation between rain fall pattern and the impact on flooding damage cost. According to Diaz and Murnane (Stephenson, Diaz, & Murnane, 2008), taxonomy of extreme weather and climate event could be consist of 3 factors, rarity, severity and rapidity. So, to see the relation of precipitation pattern variable and flooding, we need also to consider these aspects. Rarity is the frequency of rain fall in the month. The severity should be considered rain fall in a day more than 50mm from standard of extreme rain fall of Japan Meteorology Agency. Rapidity is the duration of flooding. Through consideration of these aspects, precipitation variable could be defined. We could not gain data of the duration of flooding, but gain the number of the days of rainfall more than 30mm per hour. Therefore, as the precipitation related variable is defined as the number of the days of rainfall more than 30mm per an hour.

As mentioned before, role of collective community activities in terms of farmland management are considered as one of the important factors of efficient implementation as community capacity. Therefore, as community capacity

aspect, the number of farmers, dummy variable of community resource preservation activities (1=do some preservation activities such as farmland and facility maintenance, 0=otherwise) are included in independent variables. Of course, there are more social capital variables such trust, network and so on (OECD 2006) , but in this study, we focus more on the PES and flooding damage cost and take the variable on community activities dummy to see social capital aspect.

As more control variables, we use the number of farmers, rate of 65 years old among farmers and land type dummy variables if it is mainly having rice paddy field or not. In addition to see the effect of PES on disaster prevention function under RCP8.5 scenario, we would like to estimate future damage cost of flooding due to unusual rain in Hokkaido where it used to have less rainy seasons and not much damage by rain compared to other prefecture in Japan.

Table 4.1. Description of variables

Variables		Explanation	Reference
Dependent variable	damage	Damage cost of flooding on agricultural sector (thousand yen) (Municipal basis)	Statistics of flooding damage. (incl. houses, office, and agricultural land, excl, Agricultural production)
	dpD	0=Not received direct payment, 1=received direct payment	Report of Implementation of DP for Hilly mountainous area (Hokkaido municipality data, MAFF)
	frm	The number of farmers (Municipal basis)	Agricultural census (municipality level)
	raincm	annual total precipitation in municipality (cm)	Japan Metrological Agency
	ov65y	% of farmers who are over 65 years old (%) (Municipal basis)	Agricultural census (municipality level)
Independent variable	comactD	The community resource preservation activities	T Takayama & T Nakatani, 2011 Agricultural census (municipality level)

Variables		Explanation	Reference
			Ito, Feuer, Kitano, & Komiyama, 2018
		(Municipal basis) 0=no activities, 1=otherwise	
	landD	Rice paddy field dummy (Municipal basis) 0= upland, 1=rice paddy	Agricultural census (municipality level)

Methodology

We would like to see if the direct payment has an impact on damage cost of flooding. We aim to see if the payment is utilizing efficiently through analysis of relation between damage cost of flooding and direct payment variable and community activities. Efficient use of direct payment which would be observed in correlation between disaster damage cost and direct payment variable which is here dpD, the area received direct payment. Since sustainable rural development requires well functioned farmland and community capacity for conservation activities, it is meaningful to analyze this correlation.

Panel Tobit model

Damage cost of flooding is 0 when municipality has no damage, but when it occurs, it shows always positive value so it is censored values. Therefore, estimator of OLS would be biased. In addition, samples are municipalities where they have farmland. It is non-random selected samples. Therefore, appropriate method in this case is to estimate by Tobit model since dependent variable is the damage cost of flooding which is either equal to zero or positive. Panel data is observing data of individuals' different sections at T different times, combination of cross-section and time data. In this

study, we utilize 3-year period of data. Tobit used in this study is therefore expressed as follows;

$Y^*_{it} = \beta' X_{it} + \varepsilon_{it}$

$Y_{it} = Y^*_{it}$ if $Y^*_{it} \geq 0$

$Y_{it} = 0$ if $Y^*_{it} < 0$,N and t=1,…,T

where *i* defines the municipality and t defines the time. X_{it} is the explanatory variables β is a vector of unknown coefficients. OLS is not suitable here because dependent variable is the censored data. Therefore, for parameter estimations, the Maximum Likelihood Estimation (MLE) method is used in the Tobit model. The error term in panel data application is generally defined as follows:

$\varepsilon_{it} = \lambda_{it} + u_{it}$

where λ is the individual effects and u_{it} is the unobservable individual and random effects(Samut & Cafrı, 2016).

$Y_{it} = \beta_0 + \beta_1 days_{it} + \beta_2 frm_{it} + \beta_3 ov65y_{it} + \beta_4 dpD_{it} + \beta_5 comactD_{it} + \beta_6 dpD_{it} + \beta_7 dpD \times comactD + u_{it}$

In the Tobit model, we would like to estimate how the changes of each independent variables would affect on y. To calculate the damage cost under RCP.8.5, we need to estimate marginal effect of precipitation. By using the marginal effect of precipitation obtained

from our model, we can estimate changes in damage cost due to change of precipitation under RCP8.5 in 14 sub-prefectures which is provided by Meteorological Research Institute of Japan. Tobit model estimates 162 municipalities in 3-year, but predicted damage cost is estimated in 14 sub-prefectures due to data availability. Table 2 shows the description of Statistics.

Table 4.2. Description of Statistics

	Mean	sd	min	max
damage	1.67	4.34	0.0	51
frm	258.30	258.22	0.0	1973
raincm	11.33	3.03	0.0	24
ov65y	0.42	0.17	0.0	1
dpD	0.58	0.49	0.0	1
comactD	0.86	0.35	0.0	1
landD	0.19	0.39	0.0	1
N	486			

During the process of analysis, we have some missing variables on one or more of period of years, but having full data of variables

on at least one period of year for 162 municipalities. Due to this missing variable, the number of observation and municipalities are not matched.

4-4. Results and Discussion

4-3-1 Result of Tobit Model

As already mentioned, in order to keep disaster prevention function, it is important to preserve farmland. The estimated variable of over 65 years old is positive and statistically not significant. Problem of aging farmers is seen commonly in many rural areas. Although it is not statistically significant, it might affect on higher disaster damage cost due to aging. The estimated coefficient of rain is positive and statistically significant. This result can mean that even in Hokkaido prefecture where it used to have less disaster of rainfall, when rain fall becomes intensively in the future, it is possible to increase damage cost of flooding in this area.

Table 4.3. Result of Tobit model

VARIABLES	Tobit	Marginal
ov65y	2.741	
	(2.699)	
Raincm	0.471***	0.02
	(0.148)	
LandD	-0.325	
	(1.122)	
comactD	6.217*	
	(3.500)	
dpD	1.216	
	(1.236)	
comactD#dpD	-7.169*	
	(3.729)	
Constant	-10.02***	0
	(2.119)	(1.178)
Observations	484	484
Number of munici_code	162	162

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

We would like to see if community resource preservation activities have effects on disaster mitigation. At the same time, we think it has different feature depending on regional condition that if the area is direct payment target area or not as seen in dummy variable *dpD*. Therefore, we estimate direct payment dummy and community activities dummy individually and added interaction variable of them dpD#*comactD*. Through the interaction variable, we are able to see the impact of community activities among two groups of DP receiving area or not receiving area. The result of *dpD* shows that it is not statistically significant and positively correlated with damage cost. It can be interpreted that area of direct payment target is mostly mountainous area. Therefore, it is likely to have more serious flooding damage, meaning more damage cost. The result of *comactD* shows positive and statistically significant. The magnitude of the coefficient tells us that even if community activities are implemented in the community's land, it does not mean that they could mitigate flooding damage in case of extreme rain which is observed recent years. However, interestingly, interaction variable of the direct payment and community activities *dpD#comact* are negative and statistically significant. It indicated that there is the disaster mitigation effect in the area of direct payment target along

with active community collective activities. As mentioned before, the direct payment for hilly mountainous area prioritizes community activities. Through the results of *dpD, comact* and *dpD#comact,* it is possible to say that the direct payment was efficiently carried out on disaster mitigation. We would like to emphasize that community activity plays an important role to mitigate disaster damage in the direct payment target area. Dummy variable of land type showed negative and not statistically significant. Here also the magnitude of the coefficient tells us that rice paddy filed is usually recognized as having water reserve ability, so it would be consistent with the fact.

4-3-2. Predicted rainfall and damage cost of flooding by marginal effect

The Representative Concentration Pathways (RCPs) describe four different 21st century pathways of GHG emissions and atmospheric concentrations, air pollutant emissions and land use. The RCPs include a stringent mitigation scenario (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6.0) and one scenario with very high GHG emissions (RCP8.5). Scenarios without additional efforts to restrain emissions called baseline scenarios lead to pathways ranging between RCP6.0 and RCP8.5. RCP2.6. It is representative of a scenario that aims to keep global warming likely below 2°C

above pre-industrial temperatures (ICCP 2014). According to Climate Change Adaptation Information Platform (A-PLAT), the average temperature of Hokkaido under RCP2.6 is estimated increasing 2.18℃ in 2031-2050, 2.14℃ in 2081-2100. The number of days of extreme rain will increase 1.16times more in 2031-2050 and 1.14 times in 2081-2100. Under RCP8.5 scenario, it estimates that temperature will increase 2.10℃ (2031-2050) 5.35℃(2081-2100) and the number of days of extreme rain will be 1.16times(2031-2050), 1.30times(2081-2100). In our study, because of data availability, RCP8.5 is used to predict damage cost of flooding in 14 prefectures of sub-prefecture of Hokkaido. According to Japan Metrological Agency, if rainfall has recorded 30mm in 3-hours, a storm warning is issued. We have the data of the number of the warning in each sub-prefecture in the future and gained marginal effect of the extreme rain of 30mm+ on the flooding damage cost. Therefore, we calculated flooding damage cost under RCP 8.5.

Table 4.4. Amount of change of rain at sub-prefecture level under RCP8.5

		Amount of Change of Rain(mm) (Y2076-2095)-(Y1980-1999)
	Hokkaido total	120.054
1	Soya	87.7653
2	Kamikawa	192.5452
3	Rumoi	162.2401
4	Ishikari	74.76388
5	Sorachi	140.2344
6	Shiribeshi	13.0203
7	Okhotsk	28.7023
8	Nemuro	85.0165
9	Kushiro	104.9755
10	Tokachi	119.9071
11	Iburi	183.3101
12	Hidaka	281.5633
13	Oshima	107.2116
14	Hiyama	164.1408

Source: Estimated by NonHydrostatic Regional Climate Model (NHRCM05). (Meteorological Research Institute of Japan)

Based on this data and applied marginal effect of rainfall variable from result of tobit model, we estimated damage cost of flooding under RCP8.5.

Table 4.5. Predicted damage of flooding under RCP8.5 (thous. yen)

	Sub-prefecture of Hokkaido	Current damage*/ha	Predicted damage/ha
1	Soya	212.0085	215.7442
2	Kamikawa	759.8798	763.9616
3	Rumoi	289.9921	294.3035
4	Ishikari	86.50152	90.54213
5	Sorachi	1873.642	1878.044
6	Shiribeshi	2397.419	2402.219
7	Okhotsk	134.4961	137.4338
8	Nemuro	207.8592	211.8997
9	Kushiro	826.7118	830.5376
10	Tokachi	181.85	185.5549
11	Iburi	385.927	389.9451
12	Hidaka	32.67772	37.47425
13	Oshima	535.4107	539.7997
14	Hiyama	942.0969	946.8984

*average of municipalities in the sub-prefecture

As we see in the table 5, predicted damage cost per ha of flooding is estimated by data of regional climate change model (NHRCM05) and marginal effect of rain. Since we assume increase of damage as linear, it could be underestimation, but still we are facing increase of damage of flooding along with increase of rain fall under extreme scenario. The point of attention is that flooding damage could affect not only that site, but also surrounding area. It means that sustainable maintenances of farmland and related infrastructure by community are necessary to preserve function of farmland.

Table 6 is showing estimated the number of heavy raining warning issued under RCP2.6 and RCP8.5 scenario.

Table 4.6. The number of expected warning issued under RCP2.6 and RCP8.5

Sub-prefecture		2041-2060		2081-2100	
		RCP2.6	RCP8.5	RCP2.6	RCP8.5
1	Soya	0.50	1.50	3.00	2.50
2	Kamikawa	-	3.00	1.50	5.50
3	Rumoi	1.00	1.09	1.55	1.91
4	Ishikari	1.38	2.13	1.38	2.63
5	Sorachi	1.50	2.00	1.38	2.75
6	Shiribeshi	1.00	-	1.00	1.00
7	Okhotsk	1.00	1.00	1.00	3.00
8	Nemuro	1.00	1.17	1.00	1.17
9	Kushiro	0.74	1.00	0.95	1.21
10	Tokachi	1.00	-	-	-
11	Iburi	0.57	1.57	0.57	1.71
1	Hidaka	0.67	0.83	0.83	1.83

Sub-prefecture	2041-2060		2081-2100	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5
213 Oshima	0.71	2.00	1.14	2.43
214 Hiyama	1.00	1.20	0.80	1.00

In all sub-prefectures except Shiribeshi and Okhotsk, the number of warning issued estimate as increasing. Hokkaido has been less typhoon or related disaster comparing to main land of Japan. These estimations tell us that it is possible that entire Japan is going to face more frequent heavy rain and necessary to prepare for the future climate incidents.

4-5. Conclusion

Multi-functionality of farmland such as disaster prevention is losing especially in un-favored lands where they face farmland abandonment due to depopulation and aging problems. To restrain farmland abandonment by direct payment could be one of the

measurements for mitigation of disaster damage. Regarding of efficient use of direct payment, we examined relation between disaster damage cost and direct payment and role of community's collective activities on preservation of farmland. We found out aging farmers had negative impact on damage cost. To secure stakeholders for disaster mitigation, it is necessary to consider shift from individual family farming to new entities of agriculture such as private company or agricultural cooperation. Through the results of *dpD, comactD* and *dpD#comactD*, we would like to emphasize that community activities are important to mitigate disaster damage as the part of direct payment program. The community activities of farmland preservation are required especially in un-favored area where it likely to be target area of the direct payment. We would like to see more detailed community capacity issue in our future research.

It would be hard to stop unusual pattern of rain fall, rural depopulation and aging problem in short period of time in reality. However, it is possible to aim at securing responsible entities to increase the number of stakeholders who can maintain community land. In the age of climate change, we would face more serious disaster in near future. Our result is estimated with extreme scenario

of RCP8.5, but currently no one is optimistic about increasing disaster frequency toward climate change. Even though efficiency of direct payment was examined indirectly, we could conclude that result of farmland preservation activities and government intervention could lead disaster mitigation. To keep multifunction of farmland is precondition for sustainable development in rural area through conservation of qualities and values of farmland. Even though we observed disaster mitigation by direct payment to see the efficient use of the payment, the result of conservation of farmland could contribute to the arguments of efficiency. It is also linking with verification of relation between importance of farmland conservation and sustainability. For more disaster mitigation activities, community capacity is a key factor as seen in the variable of community activities. This is also seen in the neo-endogenous rural development theory that capacity building of partnership and its regulation for fostering community capacity are necessary for bottom-up and endogenous development which induces sustainability. The results of this research could bring the evidence of importance of farmland conservation and community capacity for sustainable rural development.

As limitation of this study, due to data availability, we have to

exclude some municipalities from the analysis. Also, damage cost includes some of the agricultural related facilities around the farmland but we could not distinguish which facilities are they. We could exclude main infrastructures such as irrigation canals, dams, bridges but still some of the private or community irrigation system might be included in the damage cost. Even so, community collective activities for farmland preservation are including facility management. Therefore, it would be not seen significant error on the data set. Also, not all the abandonment was restrained by direct payment as we mentioned.

Chapter 5. Conclusion and Policy Implication

This dissertation is trying to investigate the effect of the direct payment policy and community capacity on farmland conservation. It also contributes to discussion on the neo-endogenous theory through empirical researches.

In chapter 3, we found out that direct payment policy of Japan is effective on the target area compared to controlled area as results of DID estimator. The findings of this study also showed us the importance of incentives for them through the government interventions. The result of the aged farmers variables give two insights to us. Firstly, the stakeholders who were engaged in community farming for a long time tend to work effectively on farmland conservation activities since this aged group can be classified as accumulated community capacity holder. If the community capacity is higher, it shows higher capacity to adapt new program by government. Secondly, it is important to empower stakeholders with governmental subsidy. The direct payment subsidy worked as incentives for those who are engaged in the conservation activities even before the implementation of direct payment policy. This study suggests us that it is important to implement policy with program including community capacity building to restrain farmland abandonment effectively so that farmland conservation activities are able to sustain within the process of fostering community capacity.

In chapter 4, the study investigates efficient use of the direct payment and role of community activities We found out aging farmers had negative impact on damage cost. It was confirmed that we need to secure

stakeholders for disaster mitigation. It is necessary to consider shift from individual family farming to new entities of agriculture such as private company or agricultural cooperation. Through the results, it is possible to say that community activities play important role to mitigate disaster damage as the part of direct payment program. The community activities of farmland preservation are required especially in un-favored area where it likely to be target area of the direct payment. We would like to see more detailed community capacity issue in our future research.

Currently in Japan, there are three kinds of direct payments; direct p ayment for hilly mountainous area, for multi-function and for farmla nd, water and environmental conservation improvement (MAFF). As discussed in the Chapter 4, it is necessary to have more discussion on the efficient implementation of Japanese type of direct payment since current policies contain multi-dimensional goals in each policy.

Sustainable rural development is highly related to local resources conservati on and collective activities of the community. To pursue sustainability on rura l development, farmland conservation is essential regarding of farm managem ent, environmental conservation and community culture and traditional inherit ance. At the same time, community's capacity which is the main actor of cons ervation activities has to be fostered. It would lead sustainability in the rural
In the near future, many of other regions/ countries will face rural degradation due to similar causes of Japanese. In this dissertation, it confirms importance of territorial integration and natural resource conservation as community asset, intervention in the form of rural policies and various stakeholders such as

cooperatives, individual farmers and government.

The findings and arguments from this research contributed to discussion on effect of direct payment and community capacity and linkage with sustainable rural development. At the same time, it contributed to verify neo-endogenous rural development theory which emphasizes multi-function of farmland and community capacity.

Japan is one of the countries where they face decrease of farmers and new entities. Therefore, it is necessary to give incentives to new entities not only for individual farmers or large scale of full-time farmers but also private company or part-time farmers and new type of farmers to secure stakeholders. Farmland use should be considered depending on the regional characteristics. In this decade, it is not easy to manage farmland only by large scale farmers or full-time farmers since the number of farmers are decreasing year by year. It is the time to include part-time or small-scale farmers and new type of entities into systematic community farmland maintenance with provision of incentives by the governmental intervention. It has to keep balance community self-sustain and governmental to pursue sustainable rural development.

There are some limitations in this study. First, these analyses are based on census data of Hokkaido prefecture where they have the largest farmland area in Japan. The current situation and problems of rural area are very different from other regions even within Japan. Secondly, since we utilized secondary data which are available in municipal level, there are some variables that we could not reflect for research questions. For instance, farmland abandonment could be influenced by farmers' behavior based on profit from the agricultural

activities. However, such monetary data is sensitive in some of municipalities where the population of the municipality is relatively small enough to identify individuals in the municipality. Lastly, because of these data limitation, some of statistical assumptions are not able to be tested. Even though we have such limitations, we utilized alternative variable selections, models and plenty of literatures to control these aspects.

For the future research, it would be meaningful to estimate the effect of farmland conservation policy in other regions where they would face the same problems such as aging problems in the rural area. In addition, comparative studies of Korea and Japan would be meaningful. I would like to leave this matter as future research topic.

Bibliography

Chapter 1

1. FAO (2005). "The effect of direct payments in the OECD countries on world agricultural markets."
2. Kajita, S. (2012). "Bottom-up, Endogenous Rural Development in Europe: Focusing on the LEADER Program." Geographical Review of Japan **85**(6): 587-607.
3. OECD (2006). The new rural paradigm: Policies and governance, Organisation for Economic Co-operation and Development.
4. Ray, C. J. H. o. r. s. (2006). "Neo-endogenous rural development in the EU." 278-291.
5. Shortall, S. and M. J. E. P. S. Shucksmith (1998). "Integrated rural development: issues arising from the Scottish experience." **6**(1): 73-88.
6. Swinton, S. M. (2000). More social capital, less erosion: evidence from Peru's Altiplano.
7. Van Lier, H. N. J. L. and U. Planning (1998). "The role of

land use planning in sustainable rural systems." **41**(2): 83-91.

Chapter2

1. Antrop, M. J. L., & planning, u. (2006). Sustainable landscapes: contradiction, fiction or utopia? , *75*(3-4), 187-197.
2. Bauer, N., Wallner, A., & Hunziker, M. J. J. o. e. m. (2009). The change of European landscapes: human-nature relationships, public attitudes towards rewilding, and the implications for landscape management in Switzerland. *90*(9), 2910-2920.
3. Buchecker, M., & Hunziker, M. (2006). The effect of consensus building processes on regional collaboration.
4. Deng, X., Xu, D., Zeng, M., & Qi, Y. J. L. U. P. (2019). Does Internet use help reduce rural cropland abandonment? Evidence from China. *89*, 104243.
5. Fung, K. Y. (2017). How Economic Dependency Was Created Through the WTO: A Case Study of South Korea. *Journal of Developing Societies, 33*(4), 469-487. doi:10.1177/0169796X17738586
6. Gerrard, J., & Gardner, R. (2002). Relationships between Landsliding and Land Use in the Likhu Khola Drainage Basin, Middle Hills, Nepal. *Mountain Research and*

Development, 22(1), 48-55. doi:10.1659/0276-4741(2002)022[0048:RBLALU]2.0.CO2

7. Hashiguchi, T. (2011). The Evaluation and Overview of Direct Payment. *Agricutural Economics Society of Japan, 82*(4), 258-264.
8. Hashiguchi, T. (2014). *Current status of agriculture and rural areas in Japan and prospect of new policy framework: comparison of the direct payment system in Japan and Europe*. Retrieved from
9. JapanMeteorological, A. (2017). *Report of Climate Change in Hokkaido. ver.2. Past 120 years and future.* Retrieved from
10. Keenleyside, C., Tucker, G., & McConville, A. (2010). Farmland Abandonment in the EU: an Assessment of Trends and Prospects. *Institute for European Environmental Policy, London*.
11. Kim, I., & Arnhold, S. J. S. o. t. T. E. (2018). Mapping environmental land use conflict potentials and ecosystem services in agricultural watersheds. *630*, 827-838.
12. Lasanta, T., Nadal-Romero, E., Arnáez, J. J. E. S., & Policy. (2015). Managing abandoned farmland to control the

impact of re-vegetation on the environment. The state of the art in Europe. *52*, 99-109.

13. Li, S., & Li, X. J. J. o. G. S. (2017). Global understanding of farmland abandonment: A review and prospects. *27*(9), 1123-1150.
14. MacDonald, D., Crabtree, J., Wiesinger, G., Dax, T., Stamou, N., Fleury, P., . . . Gibon, A. (2000). Agricultural abandonment in mountain areas of Europe: environmental consequences and policy response. *Journal of environmental management, 59*(1), 47-69.
15. MAFF, M. o. A. F. a. F. The transition of EU CAP and renewed CAP (2014-2020). . *Retrieved from http://www.maff.go.jp/primaff/kanko/project/attach/pdf/160331_27cr10_01_cap.pdf. (in Japanese)*.
16. Melendez-Pastor, I., Hernández, E. I., Navarro-Pedreño, J., & Gómez, I. (2014). Socioeconomic factors influencing land cover changes in rural areas: The case of the Sierra de Albarracín (Spain). *Applied Geography, 52*(C), 34-45. doi:10.1016/j.apgeog.2014.04.013
17. Ray, C. J. H. o. r. s. (2006). Neo-endogenous rural development in the EU. 278-291.

18. Renwick, A., Jansson, T., Verburg, P. H., Revoredo-Giha, C., Britz, W., Gocht, A., & McCracken, D. (2013). Policy reform and agricultural land abandonment in the EU. *Land Use Policy, 30*(1), 446-457.
19. Sidle, R. C., Gomi, T., Akasaka, M., & Koyanagi, K. J. A. (2018). Ecosystem changes following the 2016 Kumamoto earthquakes in Japan: Future perspectives. *47*(6), 721-734.
20. Su, G., Okahashi, H., & Chen, L. J. S. (2018). Spatial pattern of farmland abandonment in Japan: Identification and determinants. *10*(10), 3676.
21. Takayama, T., Hashizume, N., & Nakatani, T. (2018). The Impact of Direct Payments in Less Favored Areas on Agricultural Land Use and Farm Numbers: An Instrumental Variable Approach with Panel Data. *IDEAS Working Paper Series from RePEc*.
22. Terres, J.-M., Scacchiafichi, L. N., Wania, A., Ambar, M., Anguiano, E., Buckwell, A., . . . Pointereau, P. J. L. U. P. (2015). Farmland abandonment in Europe: Identification of drivers and indicators, and development of a composite indicator of risk. *49*, 20-34.
23. Uetake, T. (2015). Public goods and externalities: Agri-

environmental Policy Measures in Japan.

24. Yabiki, N. (2015). Analysis of the abandonment of cultivated area and community-based farm cooperatives from statistical data. *National Agriculture and Food Research Organization*(217), 75-83.
25. Yoshito Tsuya, N. S. (2013). An Analysis of Consequences for the Bavarian Farm Finance of Direct Payments Modification. *Japanese Journal of Farm Management, 51*(2), 102-107.

Chapter 3

1. Akamani, K., & Hall, T. E. (2015). Determinants of the process and outcomes of household participation in collaborative forest management in Ghana: A quantitative test of a community resilience model. *Journal of environmental management, 147*, 1-11.
2. Austin, P. C. J. M. b. r. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *46*(3), 399-424.
3. Chamberlain, G. (1978). *Omitted variable bias in panel data: estimating the returns to schooling.* Paper presented at the Annales de l'INSEE.
4. Comission, E. (2011). Common Agricultural Policy towards 2020 Assessment of Alternative Policy Options *COMMISSION STAFF WORKING PAPER IMPACT ASSESSMENT*.
5. Deininger, K., & Jin, S. J. J. o. D. E. (2005). The potential of land rental markets in the process of economic development: Evidence from China. *78*(1), 241-270.
6. FAO. (2006). Agriculture and the environment: changing pressures, solutions and trade-offs.

7. Hashiguchi, T. (2011). The Evaluation and Overview of Direct Payment. *Agricutural Economics Society of Japan, 82*(4), 258-264.
8. Hirasawa, A. International Comparison of Direct Payment. Retrieved from http://www.maff.go.jp/j/kokusai/kokusei/kaigai_nogyo/k_syokuryo/attach/pdf/itaku29-3.pdf
9. Ito, J., Feuer, H. N., Kitano, S., & Asahi, H. (2019). Assessing the effectiveness of Japan's community-based direct payment scheme for hilly and mountainous areas. *Ecological Economics, 160*, 62-75.
10. Keenleyside, C., Tucker, G., & McConville, A. (2010). Farmland Abandonment in the EU: an Assessment of Trends and Prospects. *Institute for European Environmental Policy, London*.
11. Khandker, S., B. Koolwal, G., & Samad, H. (2009). *Handbook on impact evaluation: quantitative methods and practices*: The World Bank.
12. Komiyama, M., & Ito, J. (2017). Policy Evaluation of the Farmland, Water and Environmental Conservation
13. Improvement Scheme: A Case Study of Shiga Prefecture.

Journal of Rural Problems, 53(2), 72-83.

14. MacDonald, D., Crabtree, J., Wiesinger, G., Dax, T., Stamou, N., Fleury, P., . . . Gibon, A. (2000). Agricultural abandonment in mountain areas of Europe: environmental consequences and policy response. *Journal of environmental management, 59*(1), 47-69.
15. MAFF, M. o. A. F. a. F. Payment for Multi-Function of Farmland. Retrieved from http://www.maff.go.jp/j/nousin/kanri/attach/pdf/h31_tamen_kettei.pdf
16. MAFF, M. o. A. F. a. F. The transition of EU CAP and renewed CAP (2014-2020). . *Retrieved from http://www.maff.go.jp/primaff/kanko/project/attach/pdf/160331_27cr10_01_cap.pdf. (in Japanese)*.
17. Ministry of Agriculture, F. a. F. M. (2015). FY2015 Annual Report on Food, Agriculture and Rural Areas in Japan.
18. Renwick, A., Jansson, T., Verburg, P. H., Revoredo-Giha, C., Britz, W., Gocht, A., & McCracken, D. (2013). Policy reform and agricultural land abandonment in the EU. *Land Use Policy, 30*(1), 446-457.
19. Senda, T. (1998). A quantitative analysis of abandoned

cultivated land in Japan. *Japanese Journal of Farm Management, 36*(1), 57-62.

20. Takayama, T., Hashizume, N., & Nakatani, T. (2018). The Impact of Direct Payments in Less Favored Areas on Agricultural Land Use and Farm Numbers: An Instrumental Variable Approach with Panel Data.
21. Takayama, T., & Nakatani, T. (2011). Preventive Effect of the Measure of Direct Payment in Hilly and Mountainous Areas on Abandonment of Farmlands: Evidence from the Paddy and Upland Areas of Hokkaido. . *Agricultural Information Research, 20(1)*, 19-25.
22. Tsuya, Y., & Sugita, N. (2013). An Analysis of Consequences for the Bavarian Farm Finance of Direct Payments Modification. *Japanese Journal of Farm Management, 51*(2), 102-107.
23. Yabiki, N. (2015). Analysis of the abandonment of cultivated area and community-based farm cooperatives from statistical data. *National Agriculture and Food Research Organization*(217), 75-83.
24. Yamashita, K. (2004). Institutional Design of Innovation of Agricultural Policy. Direct Payment and Farmland, Entity

of Incorporated. *RIETI Policy Discussion Paper Series, Research Institute of Economy, Trade and Industry.* (04).

25. Yonezawa, K., & Takeuchi, K. (2003). The Effects of Direct Payment in Hilly and Mountainous Areas for Maintaining Ecological Functions at a Village Scale. *Journal of Rural Planing Association, 22*(1), 17-25.

Chapter 4

1. Antrop, M. J. L., & planning, u. (2006). Sustainable landscapes: contradiction, fiction or utopia? , *75*(3-4), 187-197.

2. Bauer, N., Wallner, A., & Hunziker, M. J. J. o. e. m. (2009). The change of European landscapes: human-nature relationships, public attitudes towards rewilding, and the implications for landscape management in Switzerland. *90*(9), 2910-2920.

3. Buchecker, M., & Hunziker, M. (2006). The effect of consensus building processes on regional collaboration.

4. Burton, R. J., & Schwarz, G. (2013). Result-oriented agri-environmental schemes in Europe and their potential for promoting behavioural change. *Land Use Policy, 30*(1), 628-641.

5. Gerrard, J., & Gardner, R. (2002). Relationships between Landsliding and Land Use in the Likhu Khola Drainage Basin, Middle Hills, Nepal. *Mountain Research and Development, 22*(1), 48-55. doi:10.1659/0276-4741(2002)022[0048:RBLALU]2.0.CO

6. Ito, J., Feuer, H. N., Kitano, S., & Komiyama, M. (2018). A Policy Evaluation of the Direct Payment Scheme for

Collective Stewardship of Common Property Resources in Japan. *Ecological Economics, 152*, 141-151.

7. Japan Meteorological Agency. (2017). *Report of Climate Change in Hokkaido. ver.2. Past 120 years and future.* Retrieved from

8. Jones, R. S., & Kimura, S. (2013). Public goods and externalities. *OECD Economics Department Working Papers No. 1053*.

9. Keenleyside, C., Tucker, G., & McConville, A. (2010). Farmland Abandonment in the EU: an Assessment of Trends and Prospects. *Institute for European Environmental Policy, London*.

10. Komiyama, M., & Ito, J. (2017). Policy Evaluation of the Farmland, Water and Environmental Conservation Improvement Scheme: A Case Study of Shiga Prefecture. *Journal of Rural Problems, 53*(2), 72-83.

11. Lankoski, J. (2016). Alternative payment approaches for biodiversity conservation in agriculture.

12. Lankoski, J., Lichtenberg, E., & Ollikainen, M. (2004). Performance of alternative policies in addressing environmental dimensions of multifunctionality. In: Helsingin yliopisto, taloustieteen laitos.

13. Lasanta, T., Nadal-Romero, E., Arnáez, J. J. E. S., & Policy. (2015). Managing abandoned farmland to control the impact of re-vegetation on the environment. The state of the art in Europe. *52*, 99-109.

14. Leimona, B., van Noordwijk, M., de Groot, R., & Leemans, R. (2015). Fairly efficient, efficiently fair: Lessons from designing and testing payment schemes for ecosystem services in Asia. *Ecosystem Services, 12*, 16-28.

15. Matzdorf, B., & Lorenz, J. (2010). How cost-effective are result-oriented agri-environmental measures?—An empirical analysis in Germany. *Land Use Policy, 27*(2), 535-544.

16. Nishizawa, E. (2017). Cost-effectiveness of Agri-environmental Payments: Theory and Practice. *The Agricultural Economics Society of Japan, 88*(4), 420-425.

17. OECD. (2006). *The new rural paradigm: Policies and governance*: Organisation for Economic Co-operation and Development.

18. OECD. (2010). Linkages between Agricultural Policies and Environmental Effect: Agri-environmental Policy Impact Model, OECD Publishing.

19. Ogawa, S., Shima, T., Yoshisako, H., & Fukumoto, M. (2005). *Evaluation of farmland conservation for preventing soil erosion*. Retrieved from

20. Pachauri, R. K., & Meyer, L. (2014). Climate change 2014 Synthesis Report-Summary for Policymakers. In: Intergovernmetnal Panel on Climate Change (IPCC).

21. Renwick, A., Jansson, T., Verburg, P. H., Revoredo-Giha, C., Britz, W., Gocht, A., & McCracken, D. (2013). Policy reform and agricultural land abandonment in the EU. *Land Use Policy, 30*(1), 446-457.

22. Samut, P. K., & Cafrı, R. (2016). Analysis of the efficiency determinants of health systems in OECD countries by DEA and panel tobit. *Social Indicators Research, 129*(1), 113-132.

23. Sidle, R. C., Gomi, T., Akasaka, M., & Koyanagi, K. J. A. (2018). Ecosystem changes following the 2016 Kumamoto earthquakes in Japan: Future perspectives. *47*(6), 721-734.

24. Stephenson, D. B., Diaz, H., & Murnane, R. (2008). Definition, diagnosis, and origin of extreme weather and climate events. *Climate extremes and society, 340*, 11-23.

25. Swinton, S. M. (2000). *More social capital, less erosion: evidence from Peru's Altiplano*. Retrieved from

26. Takayama, T., & Nakatani, T. (2011). Preventive effect of the Measure of Direct Payment in Hilly and Mountainous Areas on abandonment of farmlands: evidence from the paddy and upland areas of Hokkaido. *Agricultural Information Research, 20*(1), 19-25.

27. Tanaka, K. (2015). The cost-effectiveness of Agri-Enviromental Payments under Alternative Targeting Strategies:Empirical Findings from The Conservation Reserve Program in U.S. *Journal of Japan Society of Civil Engineers G (Environment), 71*(3), 93-101.

28. Uetake, T. (2015). Public goods and externalities: Agrienvironmental Policy Measures in Japan. *OECD Food, Agriculture and Fisheries*

29. *Papers No. 81*.

30. Uetake, T., & Sasaki, H. (2016). Japanese direct payment for environmentally friendly farming and evaluation of its environmental impacts. *Nōgyō keizai kenkyū*.

31. Van Lier, H. N. J. L., & Planning, U. (1998). The role of land use planning in sustainable rural systems. *41*(2), 83-91.

32. Wunder, S. (2005). Payments for environmental services: some nuts and bolts.

33. Yonezawa, K., & Takeuchi, K. (2003). The effects of direct payment in hilly and mountainous areas for maintaining ecological functions at a village scale: A case study in Tokamachi-shi, Niigata prefecture [Japan]. *Journal of Rural Planning Association (Japan)*.

34. Xia W, Tanaka K. (2018). Prefectural panel-data Analysis of the Factors in the Adoption of the Agr-Environmental Direct-Payment Program. Japanese. *Japan Society of Civil Engineers (Japan)74(3),110-116.*

Chapter 5

1. Park, S.-H. (2004). "Comparative Analysis of Direct Payment between South Korea and Japan." The farm management society of Japan **42**(1): 191-194.

2. Shinagawa, M. (2009). "Development and Challenges of the direct payment policy for less favoerd land in South Korea." the Agricultural Economics Society of Japan **80**(4): 163-173.

3. MAFF Ministry of Agriculture, Forestry and Fisheries
4. retrieved from http://www.maff.go.jp/j/lower.html#6 accessed December 2019.

Abstract
(KOREAN)

전 세계적으로 경제적 악순환이 발생하고 있으며, 특히 농촌에서 빈번히 관찰되고 있다. 농지 경작 포기는 많은 농촌지역에서 발생하는 경제적 악순환의 과정 중 하나로 농촌경제악화, 인구 감소, 저생산, 인구유출 및 식량자급률 저하 등을 발생시키고 이는 다시 농지 경작 포기 증가로 이어지게 된다. 따라서, 농지의 다면적 기능의 가치를 정확히 이해하고, 경작포기지의 확산을 방지함과 동시에 지역사회역량의 육성이 필수적이다. 또한 소위 지역자원, 즉 여기서의 농지의 다면적 기능의 보전과 지역사회역량의 중요성은 신 내생적 성장이론의 핵심가치 중 하나이며 지속적인 농촌개발의 논의에서 빼놓을 수 없는 요소로서 인식된다. 이러한 중요성에 비추어볼 때, 농지의 다면적 기능을 유지하고 지역사회역량을 육성하는 등의 정책은 비단 일본뿐만 아니라 다른 국가의 농촌지역에서도 유효할 것이다. 그러나 실증연구를 중심으로 한 농촌 발전에 관한 논의는 아직까지는 미비한 현황이다. 이에 본 논문에서는

일본 중산간 지역의 직접지불제도의 유효성과 지역사회역량의 효과를 검증함과 동시에 이들이 지속가능한 농촌개발과 어떻게 연계되고 있는지를 살펴보고자 한다. 연구 결과, 영토 보전적 관점과 농촌지역공동체 재산으로서의 농지의 다면적 기능의 중요성을 재확인하였을 뿐만 아니라, 농촌개발 정책과 다양한 수요자(Stakeholder)의 중요성 역시 실증연구를 통해 입증하였다. 즉, 지속가능한 농촌개발의 주요 요소로는 정부의 효과적인 정책적 개입과 다양한 수요자(Stakeholder)가 꼽히나 그 구체적인 분석은 미흡한 바, 본 연구에서는 지속가능성이 무엇인지를 농지의 다면적 기능과 연관지어 분석하여 지속가능한 농촌개발에 대한 구체적인 제언을 제시하였다. 또한, 농지의 다면적 기능을 유지하기 위해서는 지역사회역량이 중요한 역할을 한다는 점은 선행연구로서 제시되어 있으나, 이에 대한 실증적인 분석은 미흡한 바 본 연구는 지역사회역량을 강조한 신 내생적 성장이론과 그 촉진에 중점을 주어 일본 직불제도의 효과에 관해 실증적으로 분석하였다.

본 논문의 첫번째 연구는 일본의 중산간 지역 등 직접지불제도와 지역사회역량효과를 검정한 것이다. 이

연구는 패널 데이터를 이용한 **Difference in differences(DID)** 기법을 사용하여 정책대상지역과 비대상 지역 간의 비교를 통해 제도의 효과를 검증하였다. 또한, 직접지불제도가 효과가 있는 경우 구체적으로 어떤 지역사회역량이 영향을 미치는지를 추정하여 결론적으로 지역사회역량을 육성하는 정부정책이 필요하다는 제언을 할 수 있었다. 결과적으로 정책대상지역은 비대상지역과 비교해서 경작 포기지 억제효과를 확인할 수 있었다. 또한, **65**세 이상 농가의 비율이 높을수록 경작 포기지 억제효과가 확인되었다. 이는 장년층의 축적이라는 지역사회역량이 정부 정책의 효율성을 높일 수 있음을 의미하며, 또한 정책의 인센티브로 인하여 지역사회활동이 더욱 활발해져 경작 포기지 억제와 연계된다. 이상의 논의에 따라 영토 보존적 정책과 농촌사회 재산으로서의 농지의 다면적 기능의 보전을 위해서는 다수의 농업 종사자가 불가피하며, 이를 장려하기 위한 직접지불제도 대상지역 선정이 필요하리라 생각된다. 경제학적으로 고려하여도 농민이 소유 농지를 포기하지 않고 유지관리하는 인센티브가 필요할 것이다.

두 번째 연구는 최근 논의되고 있는 직접지불제도의

효율성에 대한 연구이다. 일본형 직접 지불제도는 직접적인 효율성을 측정하기 어렵다. 그 이유는 생물 및 토양의 개선이라는 명확한 목표를 설정할 수 없기 때문이다. 따라서 본 연구에서는 농지의 다면적 기능 중 농지의 수해제어효과를 효율성의 기준으로 사용한다. 중산간지역 등 직접지불제도에 의해 경작 포기가 억제된 토양이 수해억제효과를 보였다고 하면 이를 효율적인 직접 지불이 실행되었다고 간주한다. 또한, 최근 예상되는 기후변화로 인해 홍수피해 증가가 예상된다. 본 연구에서는 **RCP 8.5** 시나리오를 토대로 장래 강수량 예측 데이터에 따라 얼마나 홍수피해액이 증가하는지를 제시하였다. 구체적으로는 패널 데이터를 사용하여 토빗모델에 의해 수해피해액과 정책대상지역간의 관계를 분석하였다. 그리고 직접 지불이 효율적으로 실행된 지역에서는 농촌사회적 특성 중 어느 특성이 강세를 보이는가를 동시에 검증하였다. 결과적으로, 정책대상지역이자 농촌 보전 활동이 활발히 실시되는 농촌공동체를 보유한 지역이 그렇지 않은 지역과 비교하여 수해피해액이 적음을 확인하였다. 이로부터 효율적으로 직불제를 실시하기 위해서는 농촌공동체에서의 활발한

농지보전활동 참여가 중요하다는 사실을 도출할 수 있다. 또한, 장래 예측 강우량에 따르면 당초 예상대로 홍수 피해액이 대부분 모든 지역에서 증가하므로, 기후변동에 직면한 현재 농지의 다면적 기능의 중요성을 재확인하고 농지보전과 농촌공동체 활성화에 힘써야 한다.

이상의 두 연구로부터 본 논문은 다음과 같은 최종 결론을 내렸다. 첫째, 농지의 다면적 기능의 가치를 명확히 이해하고 경작포기자를 억제하는 것이 지속적인 농촌개발에 있어 핵심이라는 점이다. 둘째, 지역사회역량의 육성이 농촌의 다면적 기능 유지 및 관리에 있어서 핵심이라는 점이다. 셋째, 농촌공동체의 공동작업이 존재하는 지역에서는 정부개입의 효율성이 매우 높기에 개인 농가 수 감소에 직면하고 있는 일본으로서는 친척 단위 참가 농업 종사자의 정부지원 및 이에 따른 인센티브 수여가 필요하다는 점이다. 장기적으로 바라보았을 때 농지의 조절을 통한 지역사회의 조정은 반드시 필요하며 설사 이것이 경제학적으로 모순된다 하더라도 농촌공동체의 특성에 의해 농지 이용 정책을 고려해야 할 것이다. 대규모 경영시행 농가, 전업농만의 농지 관리는 현대에서는

어려우며 겸업농가 및 자급적 농가의 존재 역시 지역 전체적인 농지관리에서는 필수 요소라 할 것이다.

핵심용어: 농지경작포기, 다면적기능, 지역사회역량, 직불제, 지속 가능한 개발

학번: **2014-31491**

Acknowledgement

I would like to thank Professor Brian Hong Sok Kim for lots of advice and supports. I am grateful to past and present members of our lab and friends for meaningful discussions and supports. Finally, I would like to thank my family for numerous supports.